AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 9, No. 8. WEEKLY. | NEW YORK, FEBRUARY 20, 1886. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

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New Timber Planing Machine.

The engraving which we present with this, represents an improved machine of the class—the largest one of which we have knowledge—built by J. S. Graham & Co., Rochester, N. Y.

This machine is built with eight rolls ten inches diameter, driven by powerful trains of gearing. It will finish timber up to 20 inches wide and 12 inches thick, on all four sides, and will remove 1½ inch in thickness and 1¼ inch in the width at one operation. The frame is 18 feet long and is cast on the tubular section plan, having two thicknesses or plates of iron, and hollow in the center and tied together by numerous struts at close intervals.

All the cutter heads are made from steel forgings, bored their entire length and fitted with hammered hard tool-steel shafts under a pressure of from 100 to 120 tons, giving all the advantages of a steel head with a hard tool-steel shaft to resist wear. The upper cylinder is nine inches diameter with four knives, and the shaft is 2¼ inches diameter turned true and accurately balanced. It is mounted in large boxes lined with the best babbitt metal. The pressure rolls on each side of the cylinder yield to the inequalities of the lumber, and are used instead of bars on this particular style of machine to obviate friction and produce better general results. The cylinder and pressure rolls, raise and lower together by turning one crank, which can be done while running. The boxes are gibbed to heavy uprights that prevent vibration during severe service.

The under cylinder is seven inches diameter—four wings—with shaft two inches diameter, and is arranged to allow of a cut from zero to three-eighths of an inch. It runs in long bearings similar to the upper cylinder, all tied together in one casting. The side cutter-heads are seven inches diameter—four knives—with shafts two inches diameter, which have three bearings, one being above the head, and all fitted with large wearing surfaces. The left-hand head will travel across the machine and joint as narrow as two inches. The spindles run on a self-oiling and self-adjusting step of steel and gun metal. The right-hand head and guide can also be changed in location, obviating the wear of knives, rolls, pressure rolls, etc., in one place continually.

The rolls are fitted with shafts three inches diameter, connected with expansion gearing, and arranged to yield to any inequalities or thickness of timber and keep clear of gum. All the upper rolls are adjusted simultaneously by power while running. They receive pressure by weights and compound levers. The driving shaft is of steel, fitted with pulleys turned inside and outside, and accurately balanced. By taking out the side heads, double surfacing 28 inches wide can be performed equally as well and fast as on the ordinary surfacing machine. The machine will feed from 25 to 60 feet per minute.

The timber is fed by six feed rolls before reaching any of the cutters, thereby insuring powerful and positive feed. It is dressed on the under side first, entering between the side cutters and upper cutters while traveling on perfect surfaces.

The lowering and raising of the lower feeding rolls obtains any desired amount of cut on the under side according to the quality of the timber. The sides or edges of the timber are dressed after leaving the under cutter, guaranteeing the perfect squaring of the three sides, as they are all acted upon within a space of 8½ inches from each other. The timber passing under the top cutter-head in a finished state, and traveling on perfect surfaces, allows the top cutter to remove the surplus thickness, and thereby insures a finished timber absolutely square on all four sides. The short distance between all the cutter-heads brings them all into action within the short space of 22½ inches. By this feature it will be obvious that a long winding timber can be kept square while being dressed.

The shipping weight of the machine is 19,000 pounds.

BARNES' UPRIGHT DRILL.

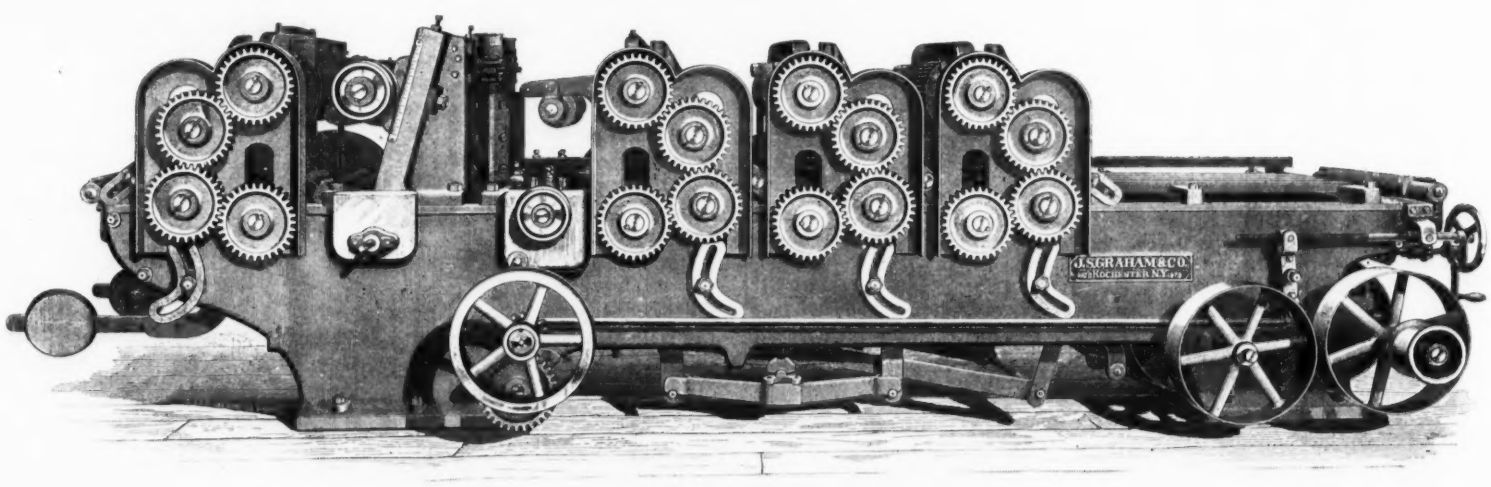
Barnes' Upright Drill.

This is a back-geared machine, having both lever and screw feed, power self-feed and quick return. Either of the feeds can be brought instantly into use, neither interfering with the other.

The back gear is internal. It is brought into or thrown out of use by dropping or raising a latch, which projects from the face of the cone-pulley. For the self-feed an eccentric is used, located on the upper cone-pulley shaft; this operates by means of a pawl and ratchet, the screw, worm-wheel, rack and pinion, and sleeve in which the spindle revolves. The rocker-shaft arm is slotted, and by adjusting the arm back and forth in this slot, the feed can be varied at will. This adjustment can be made while the drill is in motion. For the screw-feed, the screw that engages the worm-wheel is located in the feed lever and has the usual hand-wheel. This screw can be raised from the worm-wheel by a thumb-latch.

The arrangement of screw for raising the platen is very convenient, the handle being within easy reach of the operator. The shipper is arranged to be operated by the foot. The spindle is fitted with "Morse" taper, and is counterbalanced by weight in the column. The height of drill here shown is 6½ feet; diameter of column, 6½ inches; diameter of spindle, 1½ inches; vertical travel of spindle, 13¾ inches; distance from spindle to base, 3 feet, 8¼ inches. The machine will drill to the center of a 25-inch circle.

The manufacturers are W. F. & John Barnes Company, Rockford, Ill.



TIMBER PLANING MACHINE.

It has been suggested that, if recent reports be true, which announce the complete success

of experiments designed to prove the practicability of telegraphing to and from moving trains, important advantages and economies in railroad operating, in addition to other uses, must result from the extended introduction of the new system. But we have nowhere seen suitable attention called to the enormous distance, in point of achievement, which lies between this system, taken in connection with the duplex, quadruplex and cable methods of telegraphing, and the earliest working telegraph.

A High-speed Engine.

During the last year or two it has come to be generally understood that large machines, driven at a comparatively low speed, were the best for electric lighting purposes; but the lighting at the Lincoln's Inn Dining Hall and Library must be considered as an exception to this rule. The dynamo here is driven at no less than 12,000 revolutions per minute, by a Parsons high-speed engine, which justifies its title by running at the same rate. It requires some mental effort to take a statement of this kind seriously; yet there is no reason to regard the Parsons motor as a toy. It was shown in action at the Inventions' Exhibition, running with unimpaired steadiness from the commencement to the close of the show. It is, in reality, a combination of turbines driven by steam, and consists of two series of parallel-flow turbines to the right and left of a central steam inlet, the steam exhausting directly from the first turbine into the second, from the second into the third, and so on through twenty turbines in each series. The steam parts with a portion of its energy in each turbine, and finally escapes at a pressure not much above that of the atmosphere. It is claimed that this is the first motor that has ever been made to work at the actual velocity of the steam as it escapes from the boiler.—*The Engineer and Iron Trades Advertiser.*

Pattern-making.

By F. W. Barrows.

BEVEL WHEELS AND SPUR WHEELS.

Sometimes one wheel of a pair gets broken, and the pattern maker has nothing to work from but the remaining wheel and, perhaps, the number of teeth in broken wheel. In order to make a new pattern, it is necessary to know the pitch, number of teeth in each wheel, and the width of face.

If it is known how many teeth the broken wheel contained, figure the diameter by the number of teeth in each wheel and make your drawing from those figures. The bevel will remain the same for any pitch if the number of teeth in each wheel remains the same.

If the number of teeth is not known, then very carefully measure the wheel to be mated at the point of teeth *a*, *b*, Fig. 4. Lay this down; then take the width of the face with your dividers, and from center *a* describe arc *c d*. Next, take the diameter of inner points of teeth as on line *e f*. Draw a line from *a* through the point where this diameter intersects the arc *c d* as at *e*, and continue it to the center line of wheel *r*. This will give the bevel of top of tooth on the wheel to be matched. To get the bevel at pitch line, and also the diameter, strike from *a*, another arc with a radius equal to half the working depth of tooth. This can usually be determined by the wear on teeth, or perhaps by the dirt and grease which has been rammed into the bottom of space by teeth on opposite wheel. In the cut, the radius of this arc will be the line *a h*. Draw a line through *h* to the point *o*, which is the center of the pair of wheels; then draw another line at right angles with *h o*, and passing through *a*. Then will the intersection of these two lines at the point *h*, be the pitch line of the pair. From *o*, draw line *o i* to show the line of shafting to which the required wheel is to be fastened. This may not always be an angle of 90°. Draw another line from *h*, to *o i*, and at right angles with *o i*. This will be practically the radius of required wheels, but may be further corrected by the pitch as found by diameter and number of teeth in opposite wheel.

A very simple way of laying out the shape of teeth, is shown by Fig. 5. If this doesn't give the best possible shape to the teeth, it has the advantage of always having the center fall within the points of teeth, and is easily worked off with less liability to error. Now, I consider the spacing of the teeth of the first importance. When this is destroyed by trying to follow some shape made up of more than two simple curves, and consequently difficult to lay out and work accurately, it is sacrificing practice to theory. This applies to spur wheels also. It is also essential that the face of teeth on spur wheels should touch all the way across the face. This is usually accomplished by making the draft on each wheel of a pair equal, and then in fitting them up, one is reversed. This is usually arranged by the designer or draughtsman. To make the teeth of bevel touch across the face they must be so worked that a line drawn from any point on the outline of tooth at the greatest diameter to the center should touch the tooth across the whole face. By means of the instrument shown in Fig. 4, this may be done very accurately.

In this tool, the rod *s* should be perpendicular to base *k*. The collar *l* is made to slide on *s*, and is clamped by screw *m*; there is another collar *n*, which is always free to revolve on *s*. This has a pin on each side, one of which is shown at *o*. These pins should be central and at right angles with *s*. This forms a joint, allowing the straight edge *p* to move up and down over the face of tooth. The trial side of straight edge, should lie in a line which runs to the center of rod *s*, and also to center of pin *o*. In use, the instrument should be made fast to the spider of wheels by screws through the base *k*. Of course the spider should be true with the rim; then locate the pin *o* by the line across its center at a distance equal to the radius of opposite wheel above the pitch line, and fasten the collar *l*. The rod *s* should of course be in the center of wheel and may be so placed by the circular base. Then the straight edge is free to move all round the wheel, and if you work off the teeth so that it will touch the whole surface you will have a pretty good wheel.

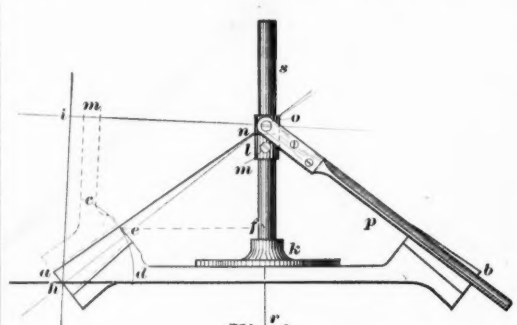
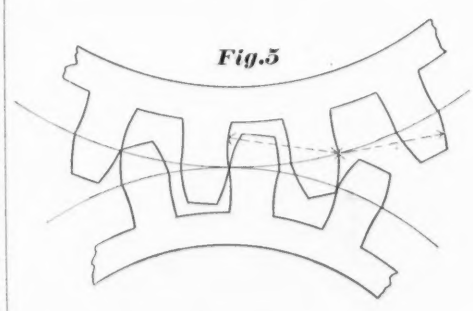


Fig.4

Fig.5



The Geology of Natural Gas.

Extracts from a paper read by Charles A. Ashburner before the American Institute of Mining Engineers:

"The existence of natural gas-springs in Pennsylvania and the adjoining States west of the crest of the Allegheny Mountains was known to the earliest settlers. Possibly the first gas obtained from a well was at Fredonia, Chautauqua County, N. Y., where a well was sunk on the bank of Canadaway Creek, near the Main street bridge, in 1821, and sufficient gas obtained for 30 burners, the inn having been illuminated by the gas when General Lafayette passed through the village about 1824. In 1858 another well was drilled, which supplied 200 burners. A still larger one was drilled to a depth of 1,200 feet in 1871. According to Mr. E. J. Crissy, Secretary of the Fredonia Natural Gas Light Company, the average monthly supply of these wells in 1880 was 110,000 cubic feet.

"Since 1859, when the drilling of oil-wells in Western Pennsylvania was commenced, natural gas has been obtained either in conjunction with oil or in wells which produced only a trace of oil. In most of the flowing oil-wells, the pressure which forces the oil up the well results from the gas contained in the oil-sand in the immediate vicinity of the well or at a considerable distance away. In the former case, gas is frequently mixed up with the oil as it intermittingly flows from the well-mouth, the gas coming from the well continuously between the oil-flows; while in the latter case, no perceptible quantity of gas is obtained from the well. I believe that, by special examination, all the oil coming from the Pennsylvania and New York wells may be proved to contain *some* gas.

"The product of gas-wells has been utilized in various ways, particularly for light and fuel at the towns and villages in the immediate vicinity of the wells, and also to a limited extent for the manufacture of lamp-black—sometimes called 'diamond black'—by the deposition of the carbon resulting from the imperfect combustion of the gas. A comparatively small proportion of all the gas produced in the region, however, was ever made use of until within two years, when the introduction of gas into the industrial establishments — principally iron, steel, and glass-work—in the vicinity of Pittsburgh has made its use as a fuel an important consideration in the manufacturing industries of Western Pennsylvania.

"The origin of natural gas has an important bearing upon its economic geology. Although it is believed that we are in possession of much data to throw some light upon this interesting question of cause, yet it is still shrouded in too much uncertainty to permit of complete explanation. It is necessary, however, that some statement should be made in regard to the origin of gas in order to thoroughly comprehend the conditions upon which its existence seems to depend. It would appear that the gas is closely related to petroleum, and that their origin is due largely to the same cause—the decomposition of animal and vegetable life. It is believed that the gas is not indigenous to the sandrock from which it is obtained, but comes from the decomposition of life-forms which were entrapped in underlying strata. If this be so, the amount of gas contained in any one sand depends, first, upon the extent to which the rocks are cracked between the horizons of such organic remains and the gas-sand reservoir in order to permit the gas to flow into the sand; and, second, upon the extent to which the rocks are cracked above the gas-sand, which would permit the gas to escape into the atmosphere and totally disappear.

"The first necessary condition for the presence of gas, however, is dependent upon the existence of a porous rock to serve as a reservoir to hold it. A number of wells have been drilled which have found gas, but, if the drillers' records are to be credited, have not pierced sand-beds; in these cases the gas has been unquestionably obtained from a crack in the strata which serves as a conduit to convey the gas from its sand-bed reservoir to the well.

"The Ridgway gas-well is located in a syncline * * * at a point where there is a certain regular dip of about 1° toward the west, on the side of the syncline. The Kane gas-wells, including the large one at Kane, which is now supplying the residents of the town with light and fuel, and the famous Kane Geyser gas-well, are both in a syncline; the south-east dip in the one case, and the north-west dip in the other case, toward the center of the basin, being less than 50 feet per mile, and the south-west dip along the axis of the basin being from 15 to 25 feet per mile.

"On the other hand, some of the largest gas-wells have been found on the crests of anticlinal axes; among them can be enumerated the Sheffield well, about two and a-half miles east of Sheffield, which was drilled in September, 1875. This well still supplies the town of Sheffield with light and fuel and has proved one of the largest and most remarkable gas-wells ever drilled in Pennsylvania. The history of this well is interesting on account of the great pressure of the gas, which made the drilling difficult. A vein of salt water was passed through at a depth of 418 feet, the water from which was permitted to leak into the well; the gas-sand, which was 45 feet thick, was struck at a depth of 1,350 feet. The great pressure under which the gas was confined in the sand-bed was relieved as the gas flowed into the well, and the sudden change of pressure caused heat to be absorbed from the water, which rapidly froze, until the well became almost entirely stopped up by the core of ice for a distance of nearly 200 feet above the gas-sand."

The New England Railroad Club.

At the meeting of the New England Railroad Club the subject under discussion was the use of iron and steel in locomotive construction. In opening the discussion Mr. Lauder said that when steel was first largely introduced he used it very generally, but now there were many places where he would not use it. He favored its use for boilers, fireboxes and tires, but would not use it for connecting-rods or parallel-rods, nor for piston-rods, crank-pins and axles. He thought steel axles were more liable to heat than those of iron; that they wore rapidly. He thought that for crossheads and driving-boxes steel castings were satisfactory.

Mr. Stevens favored iron for boilers, but used steel for piston-rods. He thought many piston-rods gave way through being improperly made. Upon the Lake Shore Road the rods were fitted into the crossheads with a taper of $\frac{1}{16}$-inch to the inch. No shoulder was left, but at the end of the fit the taper was changed and continued to the outside of the rod. There should never, under any circumstances, be a shoulder, for that is where eight-tenths of the breakages occur.

Mr. Griggs considered steel best for crank-pins. He did not allow excessive use before replacing.

Co-operation has been tried at Phœnixville with apparently good results. The business was chiefly in groceries and, for about three months, in coal. Six per cent. interest was paid on the capital, and, after paying all expenses, allowing ten per cent. for depreciation of fixtures, and putting away five per cent. in a sinking fund, there still remained four hundred dollars which had been distributed to customers of the store in proportion to their respective purchases. This final division amounted in the last quarter to seven per cent, for non-members. Coal has been sold at $1.10 per ton less than the regular rate, and the society claims to have saved the people of the town in this item alone at the rate of $15,000 per annum, through its own sales and the effects of its competition. *Philadelphia Ledger.*

The Prevention of Railway Accidents.

A very successful public trial of a fog-signaling apparatus (the invention and patent of Mr. Thomas Barrow, of Rock Ferry) took place on the Wrexham, Mold and Connah's Quay Railway, between Gwersyllt Station and Wrexham, in the presence of a number of railway officials, last week. Before speaking of the trial, it will be necessary to speak of the invention itself. 1. A signal about two feet high is placed in the six feet opposite the distance signals, and this is connected with the signal-box and the station platform, and is worked by means of a compensation wheel. 2. There is a signal lamp outside the cabin which works in conjunction with the wheel, and a shade is lifted up when the signals are

at danger; so the entire responsibility does not rest with the signalman, as the station-master can warn him of any neglect by ringing a small bell. From the box to the six-feet signal (on which a danger light can be placed during the night) a wire runs along the side of the metals, and attached to it at certain intervals are fog signals. In the case of unexpected danger, a turn of the wheel places the six-foot signal at danger and puts the fog signals on the line. Thus we have at once a simple and effective apparatus for saving life. The object of the trial at Gwersyllt was to see what would be the effect in tunnels and underground railways. The fog signals were placed a hundred yards apart, and it was found that a man 900 yards off could put on these fog signals with his hand, while the distance covered by the lever was considerably greater. The whole trial was a great success, and those present expressed their sense of the simplicity of the invention, and the small cost at which it could be fixed.—*The Railway Review (London).*

Send Copies, Not Originals.

It is not our custom, as our readers know, to refer in our reading columns to our advertising departments. The "Wanted" column on page 10 however, has a special interest to a great number of readers who are desirous of obtaining situations, or procuring "the right man" to fill "the right place" in their employment. Many very desirable situations have been obtained in this way; but where a man is advertised for to fill a certain place, it is apparent that only one applicant can obtain it. Persons who wish to apply for such places, whether the advertiser's name is withheld or stated in the advertisement, should, in applying, do so by letter, addressed to the advertiser, and where references are furnished, by all means *let them be copies*, and not original papers too valuable to lose by accident or oversight. Compliance with this latter suggestion will avoid inconvenience in many cases.

The latest combination is an automatic damper regulator and horse-feeder combined. As the function of a damper regulator is usually to control the admission of air to the furnace, analogy would lead one to suppose that the diet of a horse fed by the same machine must consist principally of wind.

The Man Who Knows Everything.

There are generally two ways in which to detect him. The first is by observing how prone he is to pick little flaws in the work of others who know more than he does. The second is, by noting in the intervals of one's own work, how little he really accomplishes.

It is a narrow-minded policy to wait until your goods are selling well in a particular section before advancing much money to push them; it is far better to spend freely, but judiciously, in territories that you propose to work, feeling confident that the more money you put out the greater will be your return in the end.—*Sewing Machine Journal.*

Receipts for making polishing powder of coal ashes are being published as something new. Fifteen years ago the impecunious small boy used to make this powder in exactly the same way, and provide his Fourth-of-July pocket money by its sale.

The following non-resident lecturers have been engaged to speak at Sibley College this winter:

J. M. Allen, C. E. Emery, J. C. Bayles, Professor Mendenhall, E. D. Leavitt, and Mr. Preston.

According to the *Times* (London) there has been a material reduction during the past few years in the cost of carrying freight by steamships, owing to increase in size of vessels. It says it required 70 per cent. more labor to work 1,000 tons of shipping in 1870 than it did in 1884.

Details of Automatic Cut-off Engine.

The Beckett & McDowell Manufacturing Company, 120 Liberty street, New York, have been for some time engaged in perfecting the details of their automatic cut-off engine; with this we present engravings representing some of these details, which will be found of interest. The engine is throughout of strong construction, and of pleasing design. The

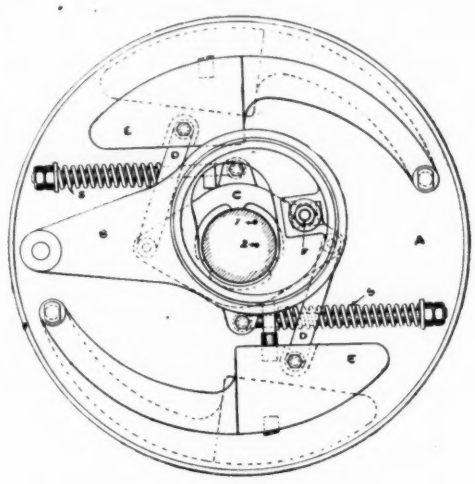


FIG. 2.—GOVERNOR.

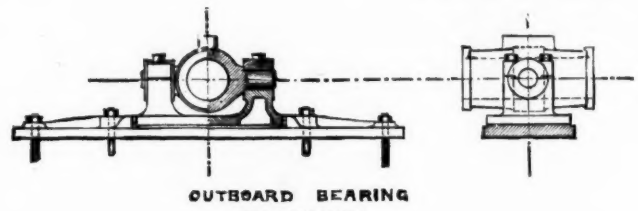


FIG. 3.

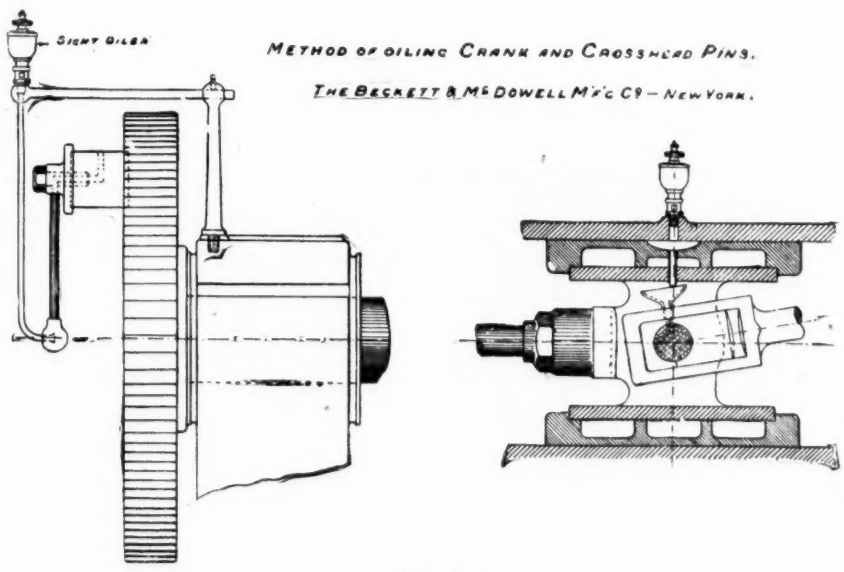


FIG. 4.

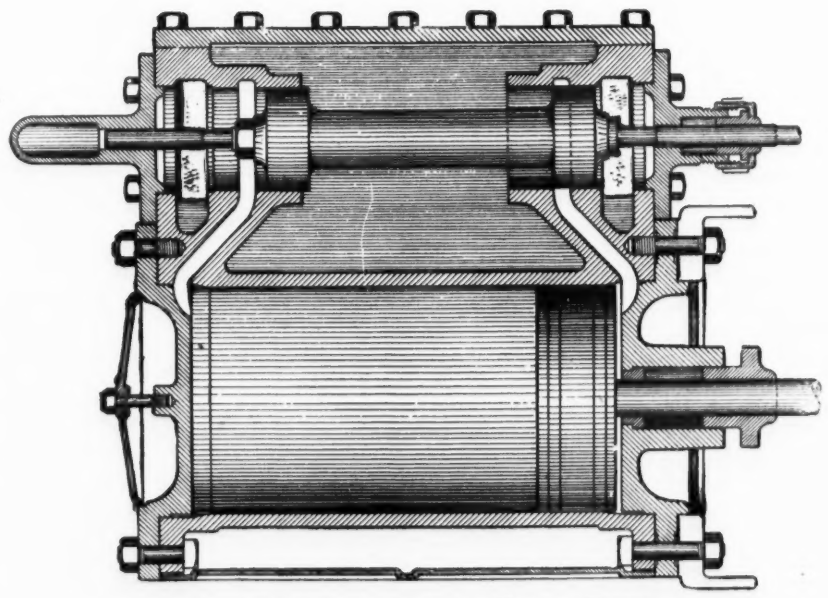


FIG. 1.—DETAILS OF AUTOMATIC CUT-OFF ENGINE.

reference to Fig. 3, consists of a long sleeve (with cap), hung on strong pivots, the whole being mounted upon a heavy sole plate.

The crosshead, Fig. 4, has a large area of wearing surface, and the pin is placed exactly in the center. The shoes are bolted firmly to the body of the crosshead, metal to metal, this part being planed perfectly true with the center line of piston-rod to facilitate adjustment, which is accomplished by the insertion of a thin liner of paper or other material of uniform thickness. This means of adjustment makes it improbable that the parts shall be carelessly adjusted out of line, and is believed by the builders to be the most satisfactory in all respects, being rigid, reliable and simple. The valve-rods work in substantial guides at the ends of the steam-chest, thus relieving the seat from weight of valve.

Fig. 1 shows a section of the steam-chest, which is cast in one piece with the cylinder. It will be noted that the piston-valve has been adopted by this firm.

Of this valve they say: "This valve seems to be the only kind capable of being perfectly balanced without the aid of rings, springs and other objectionable attachments, The only objection ever offered to this type of valve, viz.: 'Its liability to wear and leak sooner than slide valves,' seems to be contradicted in actual practice, as they will run longer, with less attention, than any slide-valve known, and even should they wear no longer than a slide-valve, they are much easier replaced when necessary, as any practical machinist will admit it is a much simpler mechanical job to ream out a round hole and turn a plug to fit it, than it would be to reface, scrape and properly fit a slide-valve and its seat, particularly if the slide-valve has one of the usual complicated arrangements attached to it, for balancing, which the piston-valve does not require. The piston-valve is coming more into use every year as its merits become known, especially on steamship engines, where, as a rule, only the best and tried is permitted to remain. It will be noted that the valve (and seat) is entirely surrounded by live steam, an important feature preventing any liability to unequal expansion. The chest is provided with a removable cover, so that the valve and seat are very easily got at and seen. The steam is taken from *between* the valves into the steam ports, exhausting at the ends. This facilitates the easy movement of valve-rod, as the packing of stuffing-box need only be tight enough to hold in the exhaust steam. The steam ports are short and the exhaust very direct, so that all undue back pressure is avoided."

Fig. 2 represents the governor or regulator. The construction and operation of this will be easiest understood by reference to the cut. The disk *A* is secured to the crank-shaft of engine. The eccentric is cast in one piece and supported by the arm *B* from a pin attached to the disk. *E E* are the governor weights pivoted on pins attached to the disk. *C* is a casting which rotates on the shaft and forms the connection between the weights and the eccentric by means of the links *D D*, and the pin and sliding block *F*. The eccentric encircles the shaft, the opening being elongated to admit of its motion. The coil springs *S S* furnish the returning force, and are so arranged that the strain on them is that of *compression* only. In the illustration above, the weights are shown at rest, whereby the eccentric is thrown over to its position of greatest eccentricity giving a maximum travel to the valve and latest point of cut-off. This position is retained till the engine is within a few revolutions of its full speed. The centrifugal force of the weights then overbalances the resistance of the springs, and the weights move outward, reducing the travel of the eccentric and valve and shortening the point of cut-off.

Fig. 4 illustrates the method adopted for oiling the crank-pin and crosshead pin, which is automatic and reliable in both instances. The crosshead pin is oiled by the surplus oil from the upper guide, being collected in a hollow cast in crosshead shoe, and conducted from thence by a pipe into an open cup on the connecting-rod. In addition to the arrangement here shown for oiling the crank-pin, there is a cup provided on the connecting-rod itself, which can be used if desired.

The complaint is very general on the part of salesmen that they must, in many instances, resort to a system of bribery of parties with whom they are brought in contact in selling. Not the proprietors, of course, but those who manage special sales departments in the business. This practice is bad in every way, and should have been broken up long ago. A few years ago venders of boiler nostrums started out with the idea that they could approach engineers in some such way, but they generally came to grief, much to the credit of engineers.

It is to be regretted that some journals, devoted to trade matters, are arguing in a serious frame of mind some of the fantastic productions of the daily press to the end that intelligent workingmen were seriously contemplating the advisability of arming and perfecting themselves in military drill. No more absurd story was ever started. There is as wide a gulf between the average workingman of this country, and the pure socialist, as there is between right and wrong.

pillow block on frame is never less than two diameters in length, fitted with side and bottom adjusting boxes and wedges. The outboard pillow block bearing is three diameters in length.

This latter bearing, as will be seen on and possesses many excellent points. It is simple, being composed of one piece only; the ports extending all around its periphery, a very short movement of valve is necessary to give the required area of opening; the valve consequently opens and closes quickly.

Locomotive Spark-arrester Castings.

By Robt. E. Masters.

With kind permission of Master Mechanic J. C. Albrect I show the moulding of some rather difficult castings for a locomotive spark arrester. It is not my intention to speak of the operation of this spark arrester, but simply to show the manner in which some of the castings were moulded.

Fig. 1 is a sectional view of the plan Fig. 2 from *A A*; each of these show two views: on the right of each the pattern is shown in the sand, as moulded; and on the left, after the pattern has been taken out, and the cores set. *B*, in Fig. 2, is a view of the left-hand side of Fig. 1, cut through at C. This casting is 36″ in diameter, 18″ deep, metal ½″ thick in the circle, and ⅜″ thick around the pockets *D D*, of which there are six.

In moulding this dome, it is placed bottom side up, on a follow board, with a block under it at *E*, which prevents the sand filling up the inside of the dome. The cheek and green sand core *F* is rammed up, and a parting made at *G*. The drag is then rammed up and lifted off. The bottom part of the pattern *H* is drawn out, the drag put on again, and the mould turned over. A parting is made at *E*; the lugs *I I* are fitted on with dove-tails, and the cope, which is barred to lift out the body of sand inside of the dome, is rammed up. After the six lugs *I I* have been drawn out of the cope, the cores, which are made in core boxes, Fig. 3, are then put into the prints, and nailed through, as shown at *J*. After the pattern has been drawn, the bottom core *K* is given a light coat of thin paste, around the print part of it, keeping clear of the vents, and set into its place with a crane.

Here is where care must be taken in making moulds of this class. It will be noticed in plan and section views of core boxes, Fig. 4, that there are recesses at *L L* for dry sand cores, made in boxes, Figs. 5 and 6. In making core *K*, in core box, Fig. 4, the sand is put in at *M*, and the core strengthened with upright rods and hoops to fit the circle. The box is then turned over, and the upper part of it lifted off; an iron frame is put on top of the lower half, filled with green sand and turned back on a core plate, and the lower half of the box lifted off.

This core is well filled with cinder and thoroughly vented, especially in the lower recesses at *L L*, as the gas from the cores, which are made in the core box, Fig. 6, to form the inside of the pockets *D D*, must escape through the core *K*, and out through the bottom of the mould, as will be readily seen in Fig. 1.

These pocket cores are 2½″ broad and ¾″ thick, and are wired and vented on the same plan as cylinder-port cores. In setting these cores, we put four tenpenny nails in the back of the pockets for the cores to rest against, *N N*, Figs. 1 and 2. The joint where the pocket cores fit into the core *K* are carefully closed up with paste and dried, as iron getting into any of these joints would result in the loss of the casting. A twentypenny nail in the cope at *O*, and the lug core *J*, hold this pocket core to its place, at the top and bottom. Very close measurements must be taken to have the lug cores *J* close down and fit nicely against the pocket cores.

The six cores *P P*, which are 1″ thick and 6′ long, are set in the upper recesses in core *K*. They form the necessary openings in the casting, and act as a bearing to hold the core *K* down.

This casting is light, weighing in the neighborhood of 300 pounds, and from the number of cores (19) set in it, the manner in which the vents had to be secured from iron getting into them, and the gas taken off, every intelligent moulder will understand that there was a good many chances of losing it, either from blowing or crushing; yet in making a number of them, we lost but one. The time consumed to produce these castings was one man's labor, one day, for each mould.

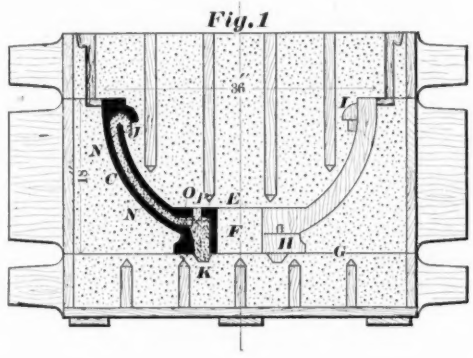


Fig.1

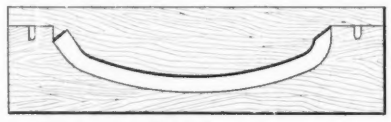


Fig.6

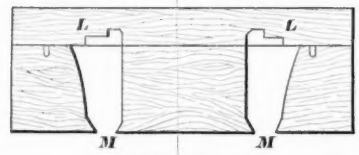


Fig.4

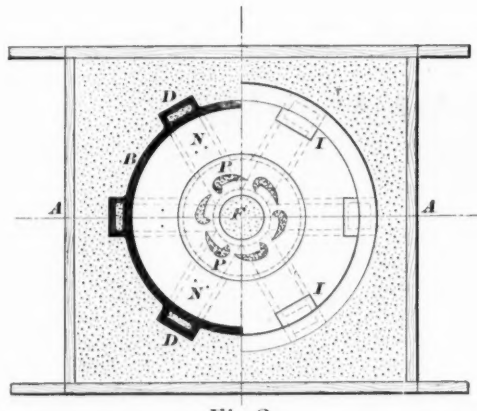
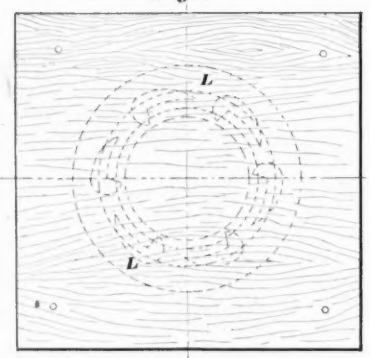


Fig.2



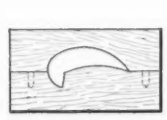


Fig.5

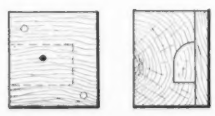


Fig.3

Spark Arrester Castings.

Recent Attempts to Increase the Economy of the Steam Engine.

For all users of steam power, but especially those possessing large engines, economy in the consumption of steam is of the greatest importance. Hitherto this economy has been chiefly attained by high rates of expansion—for instance, by means of triple compound engines, employment of steam jacket, prevention of leakage, automatic regulation of the cut-off according to the resistance encountered by the engine, and diminution of friction.

There is, however, another source of economy, which has occupied the attention of our inventors, but with like results—namely, the utilization of latent heat of the exhaust steam. It is well known that the greatest portion of heat required for the production of high-pressure steam is absorbed for the conversion of water into low pressure steam, and that in non-condensing engines this heat escapes with the exhaust. The application of a condenser recovers a portion of the heat by diminishing the back pressure on the piston, while the rest serves to heat the condensing water. Thus, unless a special use can be found for the exhaust steam, as, for instance producing a forced draft, the greatest portion of the latent heat of steam is practically wasted.

The invention of the well-known exhaust injector represents a step in the right direction, utilizing, as it does, a portion of the exhaust steam for forcing the feed-water into the boiler, while the greatest part of the exhaust steam is still allowed to escape. A more ambitious attempt was exhibited at the Inventions Exhibition, in the shape of a steam engine, which is claimed to effect an enormous saving of steam, by pumping a portion of it back into the boiler before the period of expansion in the cylinder begins. The inventor seems to have overlooked the circumstance that the work absorbed for this operation would be at least equal to that which has previously been obtained from the same quantity of steam.

Recently, however, a German engineer has adopted an entirely different, and more hopeful method of obtaining a continuous circulation of the exhaust steam, He applies a series of injectors for forcing a portion of the exhaust steam, not into the boiler, but into a receiver, from which the steam mixture is admitted to the valve-chest of the engine. Steam at a very high pressure (up to 900lbs. per square inch), is generated by a specially-constructed boiler, resembling that of Herreshoff, and is then led to a multiple injector apparatus, having a series of nozzles, each of which is situated in a separate steam chamber. The blast formed by the first nozzle acts by motion on the steam discharged from the low-pressure cylinder of a compound engine, thus compressing the said exhaust steam and forming a mixture having a pressure intermediate between that of the steam generator and that of the exhaust. This mixture is not allowed to come to rest, but is passed through the second nozzle (in line with the first) so as to form a second blast, which acts by suction on the steam which left the high-pressure cylinder, thus drawing a portion of the steam from the receiver of the compound engine, while the rest enters from the receiver into the low-pressure cylinder, and expands therein as usual. The result of this second suction is a mixture at a pressure lower than that of the steam in the receiver. This mixture is now conducted into a steam chamber, which supplies the valve-chest of the high-pressure cylinder. Instead of forming two suction blasts, three may be formed in succession, each of which acts on steam of different (but successively increasing) pressure, if the receiver has two compartments, and different grades of expansion are employed on the two sides of the high-pressure cylinder. In this manner a portion of the steam used in the cylinder is returned to the steam chamber and used again, while the rest is allowed to escape.—*Mechanical World.*

A correspondent has trouble with the burning out of a wrought-iron smoke-stack. The stack is 22 inches diameter, and a brick connection, six feet long, leads from a furnace, in which tan-bark is burned for a 42-inch tubular boiler, to the stack. Grate surface, 30 square feet. The stack has burned out four times in two months. He would like to know from any reader of the American Machinist who has had similar experience if there is any means to prevent the formation of soot in the stack, or of dislodging it before it takes fire; also if a larger stack would be less liable to burn out, or of any other means of preserving the stack.

Blow-pipes.

By James F. Hobart.

Although a blow-pipe is not an absolute necessity in the machine shop, it often proves a very handy tool. After once getting accustomed to working with a blow-pipe, we will not be able to see "how we ever got along without it."

Gas is the best material for a flame to use with the shop blow-pipe, but if not attainable we may use alcohol, or even kerosene and lard oil with good results.

The cheapest, and perhaps the best rig, when gas and the forge blower are available, is to rig up two small nozzles, made to stand at an angle of 90 degrees with each other, like the nozzles of that well-known instrument, the atomizer. Supply each nozzle with a valve of its own, then fit pieces of rubber tubing to the nozzles and connect with a gas-pipe and the blower-pipe. For common shop use the two nozzles may be $\frac{1}{16}$ inch in diameter, but different sizes may easily be attained by removable tips of various dimensions, and different shaped section of aperture.

A very handy rig, which we once made for heavy soldering, consisted of a brass casting, cored and drilled to receive two valves, and to form the desired passages. The gas was supplied through a small rubber tube which was in turn enclosed in the air tube, which was made large enough to receive it. By this method one tube was kept from being constantly in the way.

A modification of this blow-pipe was attempted by enclosing one nozzle in the other after the style of an inspirator, and also by using dry steam instead of cold air, but with indifferent success.

A tin campaign torch, with a generous wick and an air nozzle soldered in place upon its side, forms the only blow-pipe arrangement known by some shops, and they never seem to realize the want of a better rig.

For nice work, where an intense heat is required, a rig like that of a Bohemian glass-blower is very good. It will produce a heat that will melt iron wire, but the concern is not very portable. A small single bellows is rigged upon a plate of iron sufficiently heavy to make it lay still on the floor when the bellows are being worked by the foot. A circular tin tank, or a barrel, is placed under the bench upon which we intend to build our blow-pipe. A rubber tube connects a sealed pipe inside the barrel, with the bellows. Upon working the bellows air is forced through the pipe, the traps or seal of which acts like a check valve, and shuts fast behind all air which comes through it.

If we fill a tank or barrel with water, and invert therein another vessel which opens downward, we have got a miniature gasometer, and the means of filling it. We may also dispense with the bellows, and attach to a blower, as with our other blow-pipe.

About 4 inches apart lengthwise, and 18 inches crosswise the table, bore four holes and insert gas burners or lamp tubes to form four very compact flames. A couple of inches from each burner, outside, so that two diagonal burners and two points will stand in a line, bore holes to receive the air tubes. Fit them in places so that the center of the horizontal opening shall be just above the top of burner or wick. Let the opening be the full size of tubes, which can be readily made by piping up with ⅜ or ½ inch gas pipe, and putting an "L" on each pipe for a top. Get some glass tubing which will slide easily into the air tubes. The "lead glass" tubing is the right kind; hold a piece over the flame of a lamp, and when hot pull apart. You now have, after clipping and smoothing the small ends with a file, two nice nozzles for your air tubes. Make two more and your rig is complete after you wind the glass with paper and fit one into each air tube, all pointing to a common center, and across the center of its own burner or wick.

The first set of air tubes will probably be

rough, and of not the exact size required for the best results. No matter, you can easily make new ones now that your machine is in trim. Make them of sufficient size to throw the hottest part of the flame to the common center or "focus." We may also help to do this by adding weight to the air tank below our bench, from which we take air at the *top*, and convey it to our four air-jets by means of rubber tubing, and the gas pipe before described.

There are various compressed gas, and gasoline blow-pipe arrangements on the market, some of which are exceedingly portable.

A very neat device, using the vapor of alcohol was, to the best of our knowledge, designed and made by Horace C. Hovey, Ayer, Mass., but like the coiled wire flexible shaft and other good things, was appropriated by, and benefited the chap who "happened along" just as the "key-hole chanced to be wide open."

The device consisted of an alcohol lamp over which was mounted a strong hollow copper ball about 3 inches in diameter. This ball was fitted with a little safety valve, a fitting tube like that of a lamp, and a pipe leading to, and acting precisely as a blow-pipe in the flame of the lamp below the ball.

Alcohol being put in the lamp, more alcohol in the copper ball, the wick is lighted. In a minute the ball becomes a boiler. The alcoholic vapor impinges direct and hot upon the lamp flame, produces a flame often 18 inches long, and of such an intensity that the apparatus at once acquired and kept the cognomen of Hovey's devil.

The Fox Universal Trimmer.

The engravings represent two views of this trimmer, as recently improved. It will cut any bevel from a square to 45° or more, and by a succession of cuts will round the end of a piece. The knives are securely fastened to the carriage, which is planed and set at right angles to the bed, working in grooves at the top and bottom of the latter. This gives the knives a firm support, compelling a straight, smooth cut. Motion is imparted to the carriage through a steel pinion, which rolls back and forth on a rack; each inch travel of the pinion moves the carriage two inches. A detachable 20-inch lever gives ample leverage.

This trimmer is especially recommended for pattern-making and cabinet work, because from the peculiar way it works it will make a smooth cut across the end of a piece of wood, doing it true and very quickly. It has a stroke of seven inches, and is four inches between guides.

Manufactured by W. R. Fox, Grand Rapids, Mich. S. A. Smith, 39 S. Canal street, Chicago, sales agent.

The soft weather that we have had this winter causes the owners of logging railroads to glory in their possessions. When there is such a season as 1884–85 was many operators who depend on horses, oxen, and sleds, are apt to speak slightingly of the enterprise that lays the iron or steel track, and then equips it with cars and locomotives; a thorough thaw, however, brings them to their knees, and they all wish they had 'em.—*Northwestern Lumberman.*

The mortar used for the external brick facing of the Forth Bridge piers below water, says *Engineering*, consists of one part of Portland cement and one part of sand lightly ground together in a mill with salt water. The average tensile strength of samples taken from the mill is 365 lbs. per square inch at one week, and 510 lbs. at five weeks after mixing.

A company has been recently incorporated calling itself, unless misreported, "The Automatic Selling Machine Company." Just what an automatic selling machine is, or what kind of business the company proposes to do, does not appear from the title of the company. Possibly, the automatic selling machine referred to is a sort of animated drummer, so to speak, and the company proposes to engage in the business of hatching them out and rearing them for the mercantile market.

LETTERS FROM PRACTICAL MEN.

Turning a Fly-Wheel.

Editor American Machinist:

A mechanic of my acquaintance was foreman of one of those small country shops, where they make and repair "everything," etc., from a harrow to an engine lathe, and from a sewing-machine shuttle to a steam boiler. The heaviest lathe in the shop was 16″ swing, and the planer would take in 24″ square. One day the owner told him that some parties "up country" wanted a 10″x18″ engine, and if they could build it, he "guessed" he could get the order. The foreman said it could be built, and the order was "booked," if the shop had an order-book, which I very much doubt. The castings were bought outside, and arrived in due time, after which the work went on smoothly enough until they came to the fly-wheel, although the cylinder was about as much as could be handled on the 16″ lathe, even with 4″ of blocking under the head and tail-stock.

The wheel was about 9′ diameter by 18″ face. This set the foreman to thinking, and in the meantime he had the wheel bored by hand. To do this, he bolted across each end of the hub a short plank, blocking up from the arms, so that between each plank and the end of the hub was a clear space of some 3″ or 4″. Holes were now bored through the planks as nearly in the axis of the wheel as possible, and a boring-bar put through, for which the holes formed the bearings. The bar was trued up by attaching to it a pointer, like the hands of a clock, and adjusting the plank bearings until the end of the pointer run true with the rim of the wheel. Cutters were then put in the bar and the wheel bored out, the feed being obtained by a long screw abutting against the outer end of the bar. The keyway was now cut and the wheel keyed on its shaft. In the meantime a hole had been cut in the shop floor some 10′ feet long and nearly 2 wide, one of the floor joists being cut out to do so, and headers being put in at each end. The foreman also got two sticks of 8″x10″ timber, each about 12′ long, and bolted them solidly to the floor at each side of the hole.

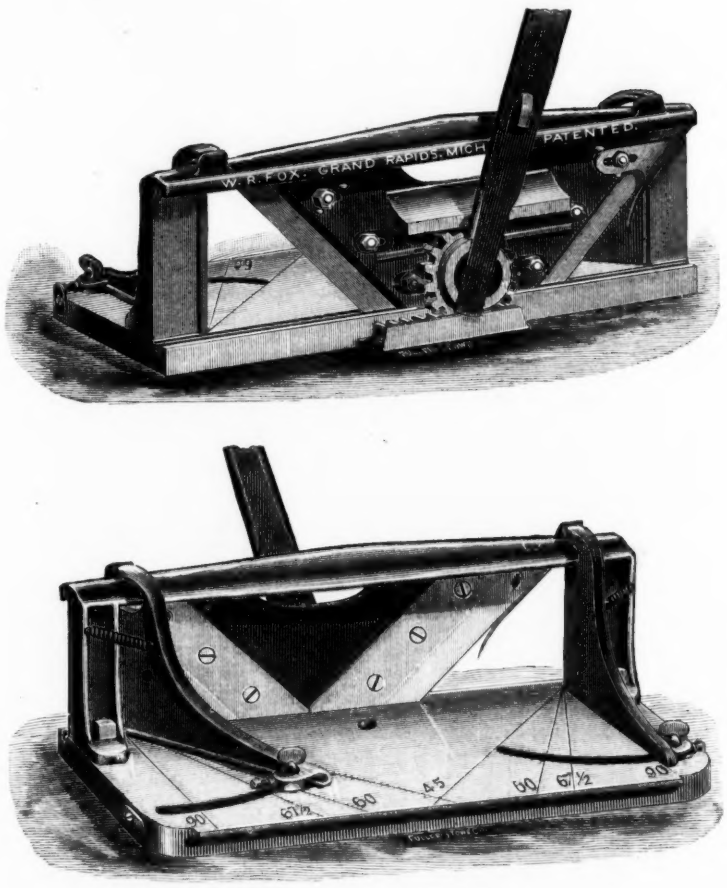
The wheel and shaft were then lowered into the opening, the shaft resting in boxes bolted to the timbers, which boxes were then "babbitted." The crosshead from the planer was placed across the face of the wheel, spanning the "grave," as the boys called the opening, and resting on the timbers at either end, to which it was securely fastened, making an admirable slide-rest.

The wheel was now ready for turning, all but a means of turning it, and in supplying this means our foreman showed evidences of that genuine Yankee ingenuity which delights in getting into a scrape for the sake of finding a way out, especially if it is away out of the ordinary course.

He rigged up an old countershaft on the floor, nearly in line with the wheel, and belted down from the main line to the counter with a quarter-twist belt. There was an old 6′ belt in the shop, which was utilized for belting from the counter to the fly-wheel, being run on one side while the other was being turned, and then shifted to the turned half while the first was being operated on.

The wheel was crowning, and to prevent the belt from running up to the center the countershaft was set "out of line," and its position changed with each shifting of the belt. Besides the necessary shifting of the driving pulley on the counter, this involved but the swinging of one end through a small angle.

The whole wheel was gone over with a roughing and then a finishing cut, making a first-class job.



THE FOX UNIVERSAL TRIMMER.

The feed was arranged by improvising a short-throw crank on the end of the shaft, and connecting it by a cord with the feed lever on the crosshead.

This rig was stiff enough to carry a heavy cut, and while I do not recollect the time required to do the job, I remember that the cost, including rigging up, was somewhat less than price wanted for turning the wheel by outside parties.

A. J. SHAW.

Crystallization of Iron and Steel.

Editor American Machinist:

In reading Mr. Goodyear's article on crystallization and granulation of metals in the issue of January 30, I was reminded of some of my experience. In the early days of mowing and reaping machines, it was the custom to use the best Norway and Swedish iron for the knife or sickle rod.

These rods after three or four years' use would break near the end where the pitman was attached, and at first we repaired by welding at the broken point. But I found that they were soon returned, broken again near the same place, but not in the weld, and that the fracture was not what I knew I should see in the kind of iron used. On further investigation I found that the iron assumed its original grain and toughness as it approached the light end of the rod, and as an experiment I cut about one-third of the rod and replaced with new iron, and had no more trouble.

On seeing this I was led to continue my investigations and found that they were never broken while at work, but when vibrating without anything to resist the vibratory force. I also found that they were liable to break where the connections with and in the pitman were allowed to be too loose.

Steel was finally adopted, and size and weight reduced, and while they lasted much longer they also had their day, and with a fracture almost as coarse as the iron. I have since seen car axles broken close to the wheel where we would not look for spring, but where it would receive the concussion from the joints of the rail causing crystallization at that point. We often see where a propeller shaft is broken the fracture is crystallized, caused possibly by the intermittent power of the engine giving a twisting concussion to the shaft.

I have known this to take place where a heavy drop-hammer was used at the end of a long line shaft.

The steam-hammer piston-rod break, mentioned by Mr. Goodyear, is possibly caused by what might be called an up-set concussion.

The concussion of the side rods of a locomotive, which are fast at both ends, may be caused by the bar itself springing.

Now, my theory is that any force in any direction whatever, that agitates the particles of the metal, will produce crystallization.

H. REYNOLDS.

Estimating the Weight of Castings.

Editor American Machinist:

The article by Mr. Gobeille on "Estimating the Weight of Castings from Wooden Patterns" is good, and if great care is used it makes guessing much easier. The idea is extremely old, over a hundred years to my knowledge (not *personal* recollection). When such a tank is large enough to take in much of a pattern, it is impossible to read the scale very closely (he only had his graduated to "sixteenths"), while it is obvious that $\frac{1}{100}$ of an inch on a tank large enough to contain the plates of a stove would be an amount which would leave it, at the best, but a close estimate. If *accuracy* is wanted in such a thing, place a sheet-metal float in one corner of the tank and to its vertical stem attach a point which may move against a scale graduated to $\frac{1}{100}$, and this float *will* indicate where the surface of water is, while in the other case a pound more or less of water may be put in or taken out without showing accurately on the wet scale.

I have used this plan where a weight of peculiar shape was wanted to balance another part. Its weight could only be determined by piling on scrap iron until it operated in a satisfactory manner. This scrap iron was then put into the tank, its bulk noted, then the pattern was trimmed until it indicated the same, and from this pattern a careful moulder made a casting which varied less than an ounce from the original scrap iron, although the weight was nearly forty pounds.

STERLING ELLIOTT.

Feed-water Temperature.

Editor American Machinist:

Mr. Jas. F. Hobart calls attention to a matter which appears to have been settled in the minds of many steam engineers upon an assumption rather than on ascertained facts. I refer to the possible limit of feed-water temperature to be obtained from exhaust steam at atmospheric pressure.

The assumption is, that exhaust steam in the heater cannot have a higher temperature than 212° without back pressure. I am not aware that this has been proved to be true in all cases.

Steam is generated from pure water at 212° under average atmospheric pressure at the level of the sea, but it is well known that its sensible heat may be further increased without changing its tension, or, as we say, superheated. Now, may not this condition of superheat sometimes obtain in the steam exhausted from the cylinders of high-pressure non-condensing engines? Of course, in an open heater, the water having only atmospheric pressure, could not be raised above the boiling temperature, as vapor would form at a greater heat, and be carried off with the

exhaust steam. In a closed heater, however, the conditions are different. The feed-water being under boiler pressure, may be brought to the temperature due to that pressure, if sufficient heat is applied to it.

The claim of heating feed-water above 212° is strenuously made by some manufacturers of closed heaters, who also claim to have established the fact by experiment. It does not appear certain that these experiments have been made with sufficient accuracy to be of value, nor, by disinterested experts. At the same time the summary disposition of such claims as impossible is hardly satisfactory.

I once asked Mr. Harris Tabor his opinion of the matter. He said he had made no investigation, but thought it probable that the exhaust might have some superheat, in certain cases, before coming in contact with the air.

To a similar question, "Chordal" replied that the temperature of exhaust steam at atmospheric pressure was generally assumed to be limited to 212°, but he did not think anybody had ascertained the fact.

Perhaps some of your readers may have made reliable experiments on this subject. The results of such experience would be of considerable general interest to engineers.

C. SEYMOUR DUTTON.

Lining Engine Lathes.

Editor American Machinist:

Scarcely a week passes but what our attention is called to a new and improved engine lathe; it seems that so many improvements in this line would not leave the mechanic any possible chance to be dissatisfied with the present mode of construction. But such is not the case. Every machinist knows that the head or center end of the head-stock spindle will wear till a certain looseness suggests that the screws be screwed down; this of course is done whenever necessary, until some one chucks out an intended straight hole and finds he has a "choke bore" of about 3°. Just here is where the trouble commences. We have to take apart, put in a thickness of zinc or brass, put the spindle in, only to find that we are not successful; we take out the brass, hunt around for an old postal card or a shipping tag which we find, (after hunting fifteen minutes for something else). A piece of the tag goes under the lower half of the bearing and the spindle is again tried; too thick. We apply two thicknesses of writing paper and try again; pretty near. But we do not have any use for an eye glass, for we can distinctly see that it does not quite line; but we are in a hurry and it will have to go.

Now, all of this time consumed in unsatisfactory adjustment is for want of some ten-cent appliance. I hope this matter will be looked into by manufacturers, but do not let the improvements stop until we get the double taper hardened and ground spindles, the angles of which, 5° and 45°, or those in combination that conform nearest to the anti-friction curve give good results. O. W. PAGE.

Waltham, Mass.

A Small Cupola.

Editor American Machinist:

Among the "Questions and Answers" in your issue of Feb. 6th, I notice the following from C. N. L.: "Would it pay to build a small cupola, as I am remote from a foundry?"

I will describe a small cupola that was constructed by J. C. Wheeler, foundry foreman of the Flushing Iron Works, the results of which I have been an eye-witness to. As it might possibly enlighten C. N. L. on the subject, I will give the exact figures. The shell in height measures 4′ from the bottom plate; diameter inside of brick lining, 17″; ordinary drop-bottom without hinges. Blast is supplied through two tuyeres, constructed of 2″ wrought-iron pipe, one on each side of the cupola, and placed at right angles to the line of the spout, and 5″ clear of the bottom plate. The only stack used is an ordinary 9″ sheet-iron pipe, leading out through the roof, the lower end terminating in a heavy sheet-iron bonnet, without lining, and of slightly greater diameter than the cupola, and suspended from the beams by two wire guys, which admits of its being swung to one side when charging up. As the cupola is constructed in two sections, and within reach of the crane, the upper one is lifted off while the lower one is being daubed, and the bottom and bed put in. Soft clay is then spread on the joint, the upper section lowered in place, and the stack swung over it. By having a loose fit through the roof, the stack can be lowered by the guys until the bonnet rests on the cupola, thereby giving an excellent draft for burning up the bed. But as soon as the blast is on, it is raised 9″ or 10″ above it, which renders lining unnecessary, and admits of charging during the cast.

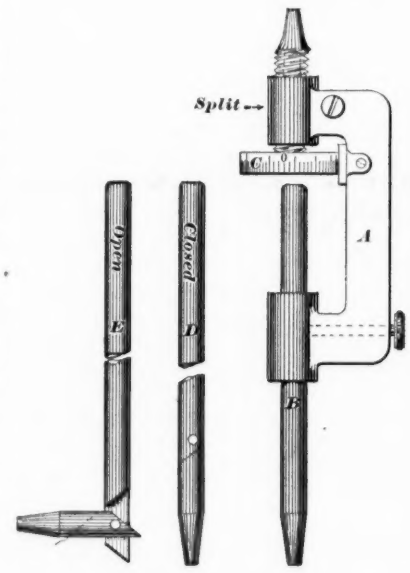
That cupola melts 1,500 lbs. of iron in an hour and a half, any day it is called on, and is certainly good for a ton, when necessary. 7 lbs. of iron to 1 lb. of coal, with 120 lbs. in the bed, is the safe and regular method of charging; and the metal is equally as fluid as can be obtained from the large cupola; castings weighing 400 lbs. each have been poured repeatedly. As these facts are authentic, it is plainly evident that a rigging of this kind would be of great advantage to C. N. L. or anyone in similar circumstances.

M. E. CHANIC.

Inside Micrometer.

Editor American Machinist:

Your issue of January 30 contains sketch of an inside micrometer caliper, which is good, but I think I have designed a micrometer for the same purpose, which contains fewer parts and is easier to construct. As is seen by referring to sketch, the principal feature consists of screw *C*, which is graduated on the inside end to fifty parts, corresponding to the thread, which is fifty. The center is



INSIDE MICROMETER.

drilled out so as to give extra range to the stems of which there can be any number of lengths. One I would call attention to is represented by *D*, *E*. The end is slotted, and a piece inserted. This stem I use for calipering eccentric straps and other work, where there are projections to prevent the withdrawal of ordinary calipers. This stem can be set to size, the end tipped back and put in or out without interfering with the size. I find this tool very handy for fitting axles, crank-pins, etc., as the allowance can be made to a nicety. I have seen several inside micrometer calipers, but none like this. I think such a tool should be in the market.

LEE C. SHARP.

Heating by Exhaust Steam.

Editor American Machinist:

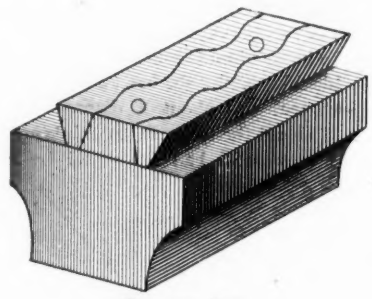
I have noticed considerable in condemnation of heating by exhaust steam, but find that our experience, and the theories advanced are somewhat at a variance. Our mode of heating is as follows: About ten feet above the engine we place a cross, one pipe running to the foundry and one to the machine shop. These pipes or headers are twice the diameter of the exhaust pipe, to allow of steam expansion, and are run to farthest point in the shop requiring to be heated. By the use of an elbow, the headers are continued to the floor, thus forming, when tapped for the coil pipes, a branch tee of large diameter. The size pipes used in the coil and drip are 1¼″. We use no weight on the back-pressure valve, which is one size larger than exhaust pipe, and is placed above the cross. As far as we can see, there is no loss of power caused by back-pressure, while the convenience and the difference in the coal bills are something worthy consideration.

H. B. HUMPHREY.

Moulding Hammer Dies.

Editor American Machinist:

I inclose you sketch, showing method of moulding hammer dies somewhat different from any I have seen. It has the advantage of being made quickly and cheaply. The dovetail piece is got out to the required



HAMMER DIE.

width and angle, allowance being made for two thicknesses of saw kerfs, doweled to back of pattern, and sawed on a tilting-table jig or band saw, the cut being of irregular form, which keeps the loose piece from sliding endwise, and also from getting mixed, as they will fit only in their proper place.

WYMAN EATON.

About Globe Valves.

Editor American Machinist:

In No. 6 W. S. Hoffman takes the ground that most engineers screw a valve too tight. Just here comes in a question, How to know when a valve is seated? A party buying valves is apt to purchase those sold fifty cents less per dozen than another make, and it is a difficult thing to find a first-class article in the market. If a valve is screwed down until it has apparently seated itself, or until it hits something hard, the possibilities are that it touches but one side of the seat, and "don't leak but little."

It is not every engineer that has a machine to refit or true up a valve, and he has to resort to a stick to hold it to regrind, and, if it was not in line before, he will make a bad matter worse, while, by giving it an extra twist when closing it in the first place, he might have crowded it on to its seat all around.

In a large brass concern a great deal of steam is used for heating liquids. One-inch valves are used, opened from ten to fifteen times a day. These valves are just seated with a pair of tongs reaching across a tub, and, from the nature of surroundings, it is impossible to give them an extra twist. These valves will have to be replaced in from four to six weeks, and are sometimes in so bad a condition as to be beyond regrinding, while other valves, out of the same lot, where care is taken to close them tightly every time, will last as many years.

Did not Mr. State make a little mistake in his article on the size of steam-ports? He says: "A 17-inch cylinder, having an area of 226.98 square inches at the piston speed of 851.2 feet per minute, will represent a consumption of

$$\frac{226.98}{144} \times 10 = 15.763$$

cubic feet of steam per second." Isn't his piston speed 14.18 feet per second, instead of 10?

W. E. CRANE.

Grate-bar Economy.

In a circular setting forth the merits of a certain grate-bar, the tenth reason why the dear public should buy these bars is:

"Because you effect a saving in wear and tear of bars and repairs, of two hundred per cent."

The difficulty which the manufacturer here referred to labors under, may, perhaps, be due to confusion of mind on this matter of percentage. An increase of 200 or 500 per cent. may be added to anything, but most people find it impracticable to subtract (or "save") more than 100 per cent. and have anything left.

Establishing a United States Test Commission.

A committee of the American Society of Mechanical Engineers is again taking up the effort to induce Congress to pass the bill, which has been before that body for some years, to establish a United States Test Commission. House bill, No. 2,083 for this purpose has been referred to the committee on manufactures.

The object of this commission is to have a body of men appointed who shall be authorities on the subject, to lay out investigations to be made upon all structural materials with a view of ascertaining what their properties are. This commission, it is proposed, shall deal with structures and not with pieces of structures, and shall ascertain in what direction the engineering of the future shall differ from that of the past, which is based so largely upon empirical rules. The commissioners to be appointed, if the bill passes, are to serve without pay, and disbursements for the work done are to be made by the Interior Department.

There are many useful results which a properly constituted Government Commission could accomplish in this direction, and the movement is especially important just at this time, when large masses of steel are likely to be required by the Government for structural and defensive purposes. It is hoped that mechanics generally will use any influence they may possess with their own or other members of Congress, to further the passage of the bill. We believe Hon. G. D. Wise, of Virginia, is chairman of the committee on Manufactures of the House of Representatives at Washington.

Inventory Valuation of Patterns.

Referring to the editorial on this subject in our January 9th issue, we are indebted to C. J. H. Woodbury, of Boston, for a copy of an office circular issued by the Associated Mutual Fire Insurance Companies. From this circular we take the following, together with the diagram annexed, showing their method of dealing with the insurance of patterns:

In the settlement of losses by fire upon patterns used in machine work, considerable difficulty has been experienced by stock companies. Lest the mutual companies should be subject to the same causes of dissatisfaction, it has been thought expedient to investigate the matter, and we have finally decided to recommend our members to adopt the system which has been long practiced by Messrs. William Sellers & Co., of keeping an account and valuation of patterns, under which there could be no greater difficulty in determining what amount of insurance should be carried in order to cover a possible loss on patterns or in settling a loss, than may occur in respect to any other apparatus.

Messrs. William Sellers & Co. have authorized us to submit the following statement and form of schedule.

On behalf of the companies,

WILLIAM F. WORCH,
December, 1885. Secretary.

"PHILADELPHIA, Nov. 9, 1884.

"*Edward Atkinson, President.*

"DEAR SIR,—It has always been our practice to keep an itemized list of our patterns, showing the first cost, last valuation, discount, present valuation. This list is the yearly account of stock. In the manufacture of patterns there is considerable time spent in alterations, etc., that would not occur in a second pattern for the same purpose. We, therefore, always discount all our new patterns, so as to allow for this and prevent an overvaluation. We do this that in closing our books we may not be deceived as to the real value of our plant. If we change a pattern during the year, the new one goes upon the list, and the old one is destroyed or carried on the list as of no value. The first valuation is carried forward each year; the present valuation of this year will be carried forward as last valuation next year, and then the discount is noted in discount column, and the difference makes present valuation, and so on.

"The first valuation is the actual cost as shown by our cost books. The discounts are made by the firm after a careful examination of each item. We can show this history for years back, and it has been our guide in buying and selling, and we think it would be sufficient and convincing for the purposes you desire.

"We follow the above system with every description of our plant down to the smallest article necessary in the transaction of our business, and have changed our equipment from time to time, as improved methods have seemed to make it advisable, and have always been able to get its stock valuation, and frequently more. This experience confirms us in our belief in the correctness of this method.

"Yours very truly,

"WILLIAM SELLERS & Co."

Heading of Blank Form used by Associated Mutual Fire Insurance Companies.

Progressive No.	Shop No.	Quantity.	Description.	Weight.	Rate.	First Valuation.	Last Valuation.	Discount.	Present Valuation.

Mr. Alex. H. Handlan, of M. M. Buck & Co., this city, has lately devised a new headlight for locomotives. The glass has a slanting pitch forward which is claimed to be an advantage, as sleet, etc., will not stick to it. This new invention is calculated, in addition to reflecting light in dark places to also reflect much credit upon the manufacturer Handlan claims that it can be seen seven miles. This, we think, depends largely on the fogginess of the night and of the individual who is trying to see it. In the latter case it may be possible for some to witness half a dozen lights where only one exists. We are inclined to believe that Mr. Handlan has at last "hit it."—*The Railway Register*.

Look to your fire-pump. If it be driven by grooved friction pulleys be sure that the driving shaft has not moved endwise enough to prevent the friction pulleys from interlocking. A collar may slip or wear; a gear may thrust the shaft endwise ½ an inch and cause serious delay in case of fire.

Tin plates, a mile in length, are what, it is gravely hinted, Sir Henry Bessemer expects to produce.

Note on the Contraction of Iron on Sudden Cooling.

BY HENRY M. HOWE, A. M., S. B., BOSTON, MASS.

[Read before the American Society of Mining Engineers.]

If a bar of wrought iron or steel is suddenly cooled from a bright red heat, the contraction which then occurs is considerably greater than the expansion previously caused by heating the bar, so that its final length is considerably less than its initial length. Mr. Thomas Wrightson has investigated this phenomenon, and has shown that not only does this permanent contraction occur on sudden cooling, but, if the heating and cooling be repeated, say fifty times, a further permanent contraction occurs at each successive cooling. It is Mr. Wrightson's opinion

STEAM GLUE-HEATER.

that this contraction cannot be explained on mechanical grounds, and he ascribes it to some molecular change caused by sudden cooling; but I think that we need not invoke mysterious molecular changes to explain this phenomenon, which appears to me to be due to very simple and purely mechanical action.

Let us consider the cooling as divided into two periods, in the first of which the exterior or skin of the bar becomes almost completely cooled, and hence tends to contract almost to its initial dimensions, while the still hot and plastic interior contracts but little; in the second period the already cool skin remains nearly constant in temperature, and hence tends to contract but little, while the interior cools from a comparatively high temperature to the ordinary temperature, and hence undergoes great contraction.

The excess of the contraction of the skin over that of the interior during the first period tends to make the bar bulge in the middle of its length. This, as well as the decrease of density which occurs, Mr. Wrightson correctly explains. The interior of the bar just sufficed to fill the skin when both were in their initial condition, before being heated at all. At the end of the first period, the volume of the still hot interior is more than the now contracted skin can hold while maintaining its initial shape; and the effect is much the same as when we powerfully blow into a soft india-rubber bag of the shape of the skin of the bar—it *bulges*, and tends to approach the spherical shape, in which the ratio of surface to volume reaches the absolute minimum. This transverse bulging permits the skin to contract longitudinally till, at the end of the first period, when it has almost completely cooled, it has returned nearly to its initial length.

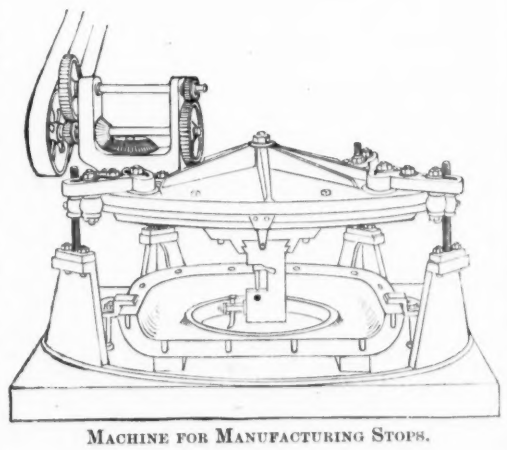
When we come to the second period, the tendency of the interior to contract as it cools is vigorously opposed by the already cold and contracted exterior, and, as Professor Stokes points out, this resistance to its contraction tends to leave the interior porous; hence the lower specific gravity of the interior of pieces thus cooled.

Now it appears to me, that this struggle between the contracting interior and the comparatively rigid skin is the cause not only of the final porosity of the interior, but also of the permanent longitudinal contraction of the piece as a whole. As the interior contracts, it tends both to draw the skin inwards and to shorten it, exerting a tremendous internal tension on it, and this pull is, of course, resisted by the rigidity of the skin. Now, both the pull of the interior and the resistance of the skin have their effects. The resistance of the skin to a certain extent prevents the interior from contracting to its initial dimensions, while the pull of the interior to a certain extent compresses the skin both longitudinally and transversely, just as a powerful external pressure would. Acting lengthwise, it causes a permanent longitudinal contraction of the skin, just as an upsetting force from without would.

This compression of the skin by the pull exerted on it by the contracting interior is probably one of the causes of the hardening of iron and steel by sudden cooling, which acts like cold rolling or cold hammering, though I believe that hardening is chiefly due to chemical rather than mechanical action.

Mr. Wrightson, as I have already remarked, believes that the permanent contraction is the result "of a change in the distance of the molecules caused by the sudden change of temperature in the successive coolings," while I believe it to be caused by the endeavor of the interior to contract after the skin has returned to approximately its initial dimensions. Now, to test the matter, we may alter the conditions so that, on the one hand, the changes of temperature shall be even more sudden than in Mr. Wrightson's experiments; while, on the other hand, hardly any contraction of the interior shall occur after the skin has completely cooled and contracted. This should afford a crucial test. If Mr. Wrightson be right, we should in this case find still greater longitudinal contraction, caused by the more sudden cooling; if I am right, we should find much less contraction, owing to the almost complete elimination of what I have called the second period of cooling.

These conditions we may obtain by suddenly cooling, not bars so thick that a very great difference exists between the external and internal temperature while they are cooling, but wires so thin that at each instant the temperature is practically uniform throughout their cross-section, so that interior and skin contract at practically the same rate, while at the same time the cooling is much more sudden than in thick bars. From the results given in the accompanying table, we see that the 1⅛ inch square bars experimented on by Mr. Wrightson contracted, under like conditions, about seven times as much as wire of No. 24



MACHINE FOR MANUFACTURING STOPS.

B. W. G., and from about ten times to about twenty-two times as much as wires of Nos. 30 and 32 B. W. G. The thin wires, moreover, contracted much less than the thick.

These results accord with my explanation.

CONTRACTION OF WROUGHT IRON ON SUDDEN COOLING.

Size of Bar or Wire.	Initial Length.	Number of Times Quenched.	Per Cent. of Contraction.	Observer.
1⅛ in. square.	30.05 in.	5	0.76 and 0.66	Wrightson.
		15	2.26 " 1.86	
Hoop, 1¼ in. sq.	57.7 in.	5	0.61	
		30	2.25	
No. 24 B. W. G.	71. in.	20	0.31*	Howe.
No. 30 B. W. G.	72.75 in.	20	7.09*	
No. 32 B. W. G.	92.75 in.	5	0.067*	

Part of the apparent contraction may have been due to slight kinking of the wires. We may certainly say that the contraction of the wires was not greater than that given in the table, and probably somewhat less.

Machine for Manufacturing Stops for Water Works.

The engraving represents a machine made by the L. B. Flanders Machine Works, Philadelphia, for the Philadelphia Water Department, and is used by them in the manufacture of large stops. It is built on the principle of the rotary planing machine, made at these works, changed to adapt it to this special work.

The machine is strongly made and geared so that a heavy cut can be taken without springing or injury. The main features are the slide and tool holder. The arrangements for truing up when worn are good, and for renewing parts subject to wear without disturbing the more expensive parts.

The machine being portable, can be moved out of the way when not in use. We are informed that with this machine at the water works a 48-inch stop can be faced off, the brass rings inserted and finished up in ten hours.

Steam Glue-heater.

This appears to be an excellent device for the purpose of preparing glue, paste, starch and similar substances. It is made of cast iron, with a hollow base in which the steam circulates. By this arrangement all joints are dispensed with, and leakage is impossible. The pots are enameled inside, which prevents discoloration of the material being prepared, from contact with the iron. The heaters are all tested under 100 pounds pressure. Manufactured by Pancoast & Maule, Philadelphia.

The editor of *The Metal Worker* says, in his paper, that he piped his residence with Bower-Barffed iron pipe in 1881, and since that time has had absolute immunity from trouble of any kind. The drip of basin cocks on white marble slabs fails to show a trace of rust discoloration, and tests for iron give no reaction. So far as he knows these were the first pipes of this kind used in this country. Treatment adds about ½ cent per pound to the cost of the iron pipe; he has no reason to suppose that the protecting surface of magnetic oxide will not last without limit. The process is applicable to all kinds of iron work, cast or wrought. Rustless iron pipe in 14-foot lengths, which can be put together by the ordinary threaded couplings, meets a great want, especially in districts where the life of lead and tin pipes is short, and for uses which do not permit the discoloration of water by iron rust.

The use of electric motors on the Baltimore and Hampden Railroad has been so satisfactory that two additional machines have been added, making four in all. The first two, named the Morse and Faraday, weighed about 4,500 pounds each, and were rated at 10 horse-power. The new motors the Ohm and the J. L. Keck, weigh 5,000 pounds, and are called 20 horse-power. The power is supplied by an engine developing about 75 horse-power, driving two Daft dynamos which supply the current to the third rail. The consumption of coal is about 1½ tons per day. The motor Morse averages a run of 75 miles per day, and has run over 1,000 miles without requiring any repairs. Two of them take the place of 30 horses. Superintendent Robbins is so well satisfied with his experience thus far in the use of electricity for street railways, that he intends next spring to equip the Catonsville road with a similar outfit.—*The Electrician and Electrical Engineer*.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.

JACKSON BAILEY, Vice-Pres't.

LYCURGUS B. MOORE, Treas. and Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, Mechanical Engineer.

The American News Company,

Publishers' Agents, New York.

The International News Company,

11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

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The American News Company, Denver, Col.
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The Montreal News Company, Montreal, Canada.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.

$2.50 a year in advance, postage prepaid in the United States and Canada.

$3.50 a year to Foreign Countries, postage prepaid, except Bolivia and South Africa, to which the subscription rate is $4.50 a year, postage prepaid.

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Transient, 35c. per line, each insertion.
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CONTENTS.

	PAGE
New Timber Planing Machine	1
Barnes' Upright Drill	1
A High-speed Engine	2
Pattern-making. By F. W. Barrows	2
The Geology of Natural Gas	2
The New England Railroad Club	2
The Prevention of Railway Accidents	2
Send Copies, Not Originals	3
The Man Who Knows Everything	3
Details of Automatic Cut-off Engine	3
Locomotive Spark-arrester Castings. By Robt. E. Masters	4
Recent Attempts to Increase the Economy of the Steam Engine	4
Blow-pipes. By James F. Hobart	4
The Fox Universal Trimmer	5
Letters from Practical Men—Turning a Fly-Wheel. A. J. Shaw—Crystallization of Iron and Steel. H. Reynolds—Estimating the Weight of Castings. Sterling Elliott—Feed-water Temperature. C. Seymour Dutton—Lining Engine Lathes. O. W. Page—A Small Cupola—Inside Micrometer. Lee C. Sharp—Heating by Exhaust Steam. H. B. Humphrey Moulding Hammer Dies. Wyman Eaton—About Globe Valves. W. E. Crane	5, 6
Grate-bar Economy	6
Establishing a United States Test Commission	6
Inventory Valuation of Patterns	6
Note on the Contraction of Iron on Sudden Cooling. By Henry M. Howe, A. M., S. B.	7
Machines for Manufacturing Shops for Water Works	7
Steam Glue-heater	7
What is Invention	8
Protection Sentiment at the South	8
Rapid Transit in New York City	8
The Gigantic Paternal Scheme of the Pennsylvania Railroad Company	8
Literary Notes	9
Questions and Answers	9
Manufactures	9
Machinists' Supplies and Iron	10

What is Invention?

The inquiry above made is of interest, not only to recognized inventors, but in even greater measure to a far larger class. Next to the ability to invent, many persons will profit almost equally by gaining knowledge as to what invention is, and when it is time to stop trying. It is always of advantage to turn a debatable border line into one which is well and plainly marked. In these days of method and system, the surveyor's chain is an emblem which should hold a higher place.

Of course, there are men to whose inventive genius metes and bounds are not to be lightly set. But it has been by no means proven that even such men work in a way essentially different in principle from that practiced by their less conspicuous fellows. And, however that may be, it is none the less doubtful whether the sum of modern progress is due as much to the labor of such exceptional inventors, as to the swarm of patient workers, the results of whose efforts, taken singly, seem to be of almost trifling importance.

The invention of printing may date from Gutenberg and the fifteenth century, but the mechanical development that has since taken place in types, presses, fixtures, accessories and methods, is, by comparison, enormous, due as it is to the efforts of almost countless workers. The steam-engine is another conspicuous instance, showing the same tendencies and effects.

The dictionary meanings of the words "invent" and "invention" doubtless took their rise generations ago, when their present acceptation was in some degree the true one. "To find," "to discover," "to hit upon," are however, definitions that by no means fully characterize the attempt of the real inventor at the present day, unless in a very exceptional degree. The great bulk of our modern industrial and scientific progress is not due to lucky accidents, to hitting upon things, to discoveries which had not been previously led up to in a hundred minor, and often apparently insignificant, ways. On the contrary, it is plainly due to a recognition of the fact that, in the main, *invention* and *suggestion* should almost be regarded as synonymous terms. The man who starts out by forming or announcing an intention to "invent" something out of hand can safely be disregarded as an immediate factor in the total of industrial progress. Nine-tenths of modern invention comes from the systematic study of that which seems already well known. The slow process by which suggestion indicates new uses and appliances is the surest foundation upon which the inventor can hope to build.

The man who feels himself ill-adapted to achieving success in this way, or unwilling to accept the restraints and requirements called for by the nature of the case, has little practical fitness for the inventor's calling. There is little room for doubt, that to disregard of conditions of this kind, often, perhaps, based upon misapprehension merely, is due a large part of the failures and misfortunes that so thickly strew the pathway of invention.

Protection Sentiment At The South.

Protection leaven is evidently working at the South, as witness the following from the *Mobile Register:*

There was a time when the great mass of the Southern people were free traders, or, rather, when they said they were, for they left such matters to the politicians, and accepted whatever ideas they promulgated. During the past ten years, and especially during the past five years, however, as manufactures have increased in the South, and as the development of its wonderful resources has proceeded, a number of our people have changed their views on this subject. They have investigated the matter, and have seen no reason for doing away with a system which has enriched the North for years, just when it is beginning to enrich the South.

Every machine shop and foundry, every cotton and woolen mill built at the South, is another argument for protection. It is not only those engaged in these shops and mills, and their owners, that will see that their interests lie in a reasonable amount of protection, but land owners come to see the value of a home market, and are soon converted from free trade propensities. This is universal experience in all parts of the country. Protection sentiment is sure to come to the front wherever manufacturing is developed. It would be suicidal on the part of the South to oppose protection and at the same time to attempt to develop its manufacturing resources. Under protection great industries will be built up in that part of the country; without it, this could not be done for many years to come.

Rapid Transit in New York City.

The citizens of New York are becoming about as much exercised over the problem of rapid transit as they were before the advent of the elevated roads. Notwithstanding the criticism these roads have received, and are receiving, they have done remarkably good work in providing means of quick transit; it is hardly possible to conceive the condition of the city at the present time without them. And considering the vast number of passengers carried they have done this work with remarkably small loss of life. It is hardly probable that any means of transit that may be devised—as underground roads for instance—will ever be able to make a better showing in this respect, or that it will be more popular than the elevated roads have been.

A good many—about all—complaints against the elevated roads are, so to speak, on general principles. The same amount of complaint would be heard against any other system that could be devised. Time is not given passengers to get on and off, it is said; if the time were made four times as long the complaints would not be materially reduced. And so with other criticisms.

The motive power of the elevated roads is kept in excellent condition, and the engines are in charge of a very competent set of engineers. Accidents to machinery are very rare. The service is good, and there is no occasion in considering other means of transit to attempt to gainsay this by statements to contrary. Undoubtedly further means of getting between the extremes of the city would be convenient, and will soon be necessary, but whether they will be below or above ground is not yet settled. There are objections to both, which require weighing carefully.

The Gigantic Paternal Scheme of the Pennsylvania Railroad Company.

The Pennsylvania Railroad Company has evolved an insurance scheme which it proposes practically to force its employes to accept. Briefly stated, it is proposed that the men are to sign an agreement with the company, which provides for the withholding of certain fixed portions of their wages for the creation of a fund from which to pay benefits in case of accidents or sickness, or a stipulated amount to the heirs in case of death. So far this would be well enough—except that the rates appear to be high—if the employes were at liberty to do as they pleased in the matter, just as they would do with any other insurance company. The Pennsylvania Company are at considerable pains to make it appear that, so far as those at present in their employ are concerned, it is optional with them to accept the insurance or not. Here is what they say in their descriptive circular:

In order that the cost of the proposed benefits may be as small as possible, and each member derive all possible benefit from his payments to the Relief Fund, the number participating must be large and regular. In view of this and the responsibility assumed by the company, it will be a condition that each person entering the service, or promoted in it after the inauguration of the department, shall become a member of the Relief Fund and participate in all of its benefits.

Most railroad employes consider themselves in the line of promotion. It is evident from the above that they will not be unless they accept the company's plan; it is just as evident that the intention of the company is to force them to accept it.

The following feature of the agreement perhaps shows up the beauties of this scheme better than any other:

My resignation from the service of said company, or my being relieved from employment or pay therein at the pleasure of the company or its proper officers, with or without cause, shall forfeit my membership in the aforesaid Relief Fund, and all benefit, right and equities arising therefrom.

This is equivalent to a life insurance company having the privilege of carrying along its insured until old age or sickness comes on, then dropping them "with or without cause." We have no idea that the courts would sustain the company in this.

The company are very careful to put into the agreement a clause to the effect that those accepting the insurance feature shall have no action against the company for damages in any event. Altogether, the scheme looks to be an excellent one for the company, and a good one for the men to let alone. There undoubtedly have been instances when large corporations have had honest intentions of benefiting their employes by some such means. This does not look like one of them. It looks like an attempt of a great corporation to get its employes more completely in its power, and, as one means of doing this, to break down such benefit societies as they have established amongst themselves.

On the whole, we believe that so far this year, as was quite generally prophesied, there has been a gradual improvement in business; it has been slow, as predicted, but it is better than standing still. It is necessary in noting progress to look at business in general, and not at some particular branch in which, for obvious reasons, there may be no improvement.

So far as can be judged at present, the prospects for a fair average production of pig iron in 1886 are good, and this means fair activity in iron business generally. There is evidence that there will be considerable railroad building, and many old roads require rails and other articles of equipment. All this will help in improving business. In machine manufacturing the steam-engine trade is fairly good in number of sales, but prices are extremely low. Those desirous of making a change in their motive power are never likely to find a time when they can do so at less cost than at the present. There is evidence that steam-engine builders are considering the advisability of ceasing the cut in prices which has characterized that trade for the past two years. From that to an advance over present prices is only a step, and one that would be warranted. The same may be said in the way of prices of machine tools. An advance in the price of machinery of all kinds would, in the end, be advantageous to buyer as well as seller. The sooner it comes, the better for all concerned. Machine business is never likely to show improvement, after periods of depression, quite as quickly as most other branches of business, but coming up to normal production in mills and factories means, eventually, work for the machine shop.

There was unusual obstruction to railroading during the month of January, and this had its effect in blocking trade to some extent, preventing as good showing for that month as would otherwise have been made; but, on the whole, there is reason for feeling encouraged. The absence of a speculative tendency, that gives spasmodic impetus to manufacturing, is one of the most encouraging features. Every advance made is real and, let us hope, permanent.

If the reduction in coal consumption, and at the same time the increase of speed of ocean steamships, which has been gradually brought about within a few years, had been suddenly achieved, it would stand as a wonderful performance in steam engineering. But it is no less wonderful as an evidence of what persistent effort in a specific direction can do, without adding anything of special importance to existing knowledge. Cutting off little wastes here and taking advantage of chances for gain there have, in the main, effected the wonderful change in the economy of the engines of ocean steamships.

Literary Notes.

STATICS AND DYNAMICS FOR ENGINEERING STUDENTS. By Irving P. Church, C. E., Assistant Professor of Civil Engineering, Cornell University. New York: John Wiley & Sons. Price $2.

This appears to be an excellent work for students of engineering, and for those who do not object to mathematical formulas. To the majority of such this book will give additional light, and they will find the matter comprehensively and carefully presented.

ELEMENTARY GRAPHIC STATICS AND THE Construction of Trussed Roofs. A Manual of Theory and Practice. By N. Clifford Ricker. M. Arch., Professor of Architecture, University of Illinois, Fellow of the American Institute of Architects and of the Western Association of Architects. New York: William T. Comstock, 6 Astor place. Price $2.

This is a book of 158 pages of graphical illustration and demonstration of the methods and principles pertaining to the construction of roofs and trusses, together with statements of the strength of materials and sizes of bolts required.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(69) J. S. S., St. Louis, Mo., asks how to make a dip to remove the scale from cast steel. *A.*—Sulphuric acid, or commercial "oil of vitriol" one part, water six parts.

(70) T. H. C., Mattoon, Ill., asks: Why are consolidated locomotives called "hogs" by western engineers? *A.*—We have referred this question to a western engineer, who replies: "Because they exhibit a tendency to wallow in the mire."

(71) P. L., Newark, N. J., asks: Can pig iron, melted in a cupola, be burned so as to lose any of its good qualities, and if so, under what circumstances? *A.*—We cannot say that it would be impossible to burn the iron in melting, but we would not know how to go about it.

(72) C. D., Keokuk, Iowa, asks: If a piece of taper work is turned in the lathe with the tool exactly at the center, then if the tool is raised above the center and another cut taken over it, will it change the taper? *A.*—Yes; or, rather, a true taper cannot be turned with the tool above or below the center.

(73) J. F., Reading, Pa,, asks: 1. Can a radiator be grained or painted to correspond with wood work. *A.*—Yes. 2. What effect would steam or heat have on it; or what loss might arise from using lead paint? The loss would be the paint and graining, which would quickly peel off; otherwise, lead paint would have no bad effect.

(74) G. H. W., Jacksonville, Fla., writes: I have built a double-hulled sailboat, 25 ft. long and 9 ft. wide. If I put in a five-foot paddle-wheel, and work it by hand, how much speed could we make with the boat, which weighs about 2,000 lbs.? *A.*—You might make three-quarters of one mile per hour, with one man at the crank.

(75) T. L. B., Wake Forest, N. C., asks: Why are smokestacks of locomotives made largest at the top? *A.*—In the stacks having large apparent area at the top, there is a cone, or some spark-arresting device. The inside device taking up considerable space the stack is enlarged so as not to be choked. Sometimes they are made a slight taper, on the supposition that it gives better draft.

(76) G. V. B., St, Louis, Mo , writes: I wish to cement together a disk of type metal and a disk of brass. I cannot use solder, and shellac does not give satisfaction. What cement will answer? *A.*—Take six pieces of gum-mastic, the size of a pea, and dissolve them in the smallest possible quantity of 95 per cent. alcohol. Soften some isinglass in water (though none of the water must be used), and saturate strong brandy with it until you have two ounces of glue; then rub in two small pieces of gum ammoniac. Mix the two preparations at a heat. Keep well stoppered. Set the bottle in hot water before using.

(77) C. F. M., San Francisco, Cal., asks: 1. How is gas introduced in the furnace of a boiler for making steam? *A.*—By means of a pipe supplying large jets. 2. Is natural gas more explosive or dangerous than artificial gas? *A.*—We believe that it is generally conceded that it is a little more dangerous, in that mixed with air an explosive mixture will be formed at a greater variety in quantities of gas and air; also its presence is not so easily detected by the sense of smelling. 3. How many cubic feet are required per horse-power per hour? *A.*—We are not acquainted with the results of any definite experiments in this direction.

(78) D. R., ———, asks: 1. How much further will a pump draw water through a pipe running at an angle of 45° than through a vertical pipe? My idea is, that it will raise the water to a level with the water in the vertical pipe. Am I right? *A.*—Yes. 2. What is the difference between one square inch and one inch square? *A.*—There is no difference. 3. Did you ever know a boiler to collapse? *A.*—No; but the flues sometimes collapse? 4. How much farther will a pump throw water on a level than vertically. *A.*—It is impossible to make any pump throw a horizontal stream. The water begins to gravitate toward the earth the instant it leaves the nozzle. To throw water to any distance, it is necessary to elevate the end of the delivery pipe, and the stream will be thrown a distance in proportion to the angle of elevation, the effect being greatest at an angle of 37½° from the horizontal. 5. If it was possible to sink a shaft from 8,000 feet above the level of the sea to the sea level, would the atmospheric compression be the same as at the level of the sea in the open air? *A.*—It would, except so far as barometric changes were concerned, where there would probably be a difference.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Power measured.–F. Van Winkle, 22 Cortlandt, N.Y.

Chas. Alt, Engraver on Wood, 318 Broadway, N.Y.

T. M. Parker, Steel Stamps, Stencils, Hartford, Ct.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 48 Beekman st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John st., N. Y.

Steel Shank, Wire Nail, Shoe Nail and Tack Machinery. Keith & Trufant, Campello, Mass.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Pattern Letters and Figures to be put on patterns of castings. H. W. Knight, Seneca Falls, N. Y.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

Patent Attorney and Expert. Machine designs and details. Wm. H. Weightman, 82 Astor House, NY

Foot-power Machinery, for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Lyman's Gear Chart. How to Lay Out Gear Teeth. Price, 50c. E. Lyman, C. E., New Haven, Conn.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Feb. 13, p. 12. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

13 engines, all sizes in store, cheap; machinery, tools and supplies; lists sent on application. Jackson & Tyler, Baltimore, Md.

E. Merritt & Co., Brockton, Mass., established 1859, only manufacturers of a complete line of Tack and Nail Machinery. Send for circulars.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-taught," $4. Books for workmen. Joshua Rose, Box 3306, New York City.

The Magic Square—A novel instrument for solving problems in arithmetic by a mechanical method without mental labor; equal to a slide-rule, twenty ft. long. By mail, 25c. W. H. Wythe, Ocean Grove, N.J.

The Chandler Water Motor.—Five years successful trial has proved the Chandler Motor to be the most reliable and economical motor made. Built in six sizes, from ⅛ to 12 horse-power. Efficiency, safety and economy combined. Send for illustrated catalogue and price-list. Factory and warerooms, 132 Oliver street, Boston, Mass.

"Locomotive Engine Running and Management." By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air-brake explained by aid of engravings. Price, $2. For sale by "National Car Builder," 187 Dearborn st., Chicago, Ill.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

Manufactures.

An enlargement of the York, Pa., rolling-mill is to be made.

A flouring mill is to be built at New La Grande, Oregon, this year.

A large brass foundry is to be erected at McKeesport, Pa., by Russell & Co.

C. M. Wheatley, Americus, Ga., proposes to establish an iron and brass foundry.

Active operations in building the Portland and Willamette Railroad, in Oregon, have begun.

The International Starch Works, recently burned at Buffalo, N. Y., will be rebuilt at once.

Young & Watson, of the Houlton (Me.) Extract Works, think of building a steam mill near their present works.

An effort is being made by Wear & Lee, of Belton, Texas, to organize a company to build a roller flour mill at that place.

Holmes, Booth & Haydens, Waterbury, Conn., are erecting a brick addition to their factory, 106x35, for manufacturing purposes.

Currier & Snyder, Worcester, Mass., are bringing out a new 20-inch back-geared drill, for which they anticipate a good demand.

The Ivens & Son Machinery Co., New Orleans, La., will increase their foundry facilities by adding machinery for doing heavier work.

Joseph Bancroft & Sons, Wilmington, Del., will commence immediately to enlarge their machine works and put in new machinery.

Adams & Price, Nashville, Tenn., have begun the manufacture of shafting, pulleys and hangers in addition to the building of locomotives.

An advance in wages of ten per cent. has been granted to the moulders at Marshall & Co.'s works, Pittsburgh, Pa.; also at Morris & Co.'s foundry.

E. H. Coates & Co., of Philadelphia, have purchased two acres of land at Augusta, Ga., upon which they will build a mill for the manufacture of yarn.

The Pioneer Mill Co., of Abilene, Md., proposes to enlarge its mill to 150 barrels daily capacity, and to build a large elevator this year.—*Northwestern Miller.*

Fay & Scott, manufacturers of machine tools and general machinery, Dexter, Maine, write us: "Orders are more plenty with us this month than for any month during 1885."

Carnegie, Phipps & Co., a recently organized firm of Homestead, Pa., intend to immediately erect a foundry and machine shop for making all kinds of castings, stationary engines, and other machinery.

According to a press dispatch Congressman Wm. Walter Phelps has offered to give an acre of valuable land along the railroad to any manufacturing company that will locate in Englewood, N. J., and give employment to workingmen of the place.

The Link Belt Machinery Co., 13 to 23 South Jefferson st., Chicago, have issued a circular and price-list describing their hub friction-clutch, which contains considerable data regarding the power of different sizes at varying speeds. It will be sent free on application.

A pumping station for drainage purposes will be established at Woodlawn, in the village of Hyde Park, Ill. The district to be drained consists of 753 acres, and works with 50,000 gallons daily capacity will be constructed. The main drain will be of brick, 60" in diameter, and empty into Lake Michigan. The total expense will be about $100,000.—*Sanitary News.*

F. W. Ulrich has lately established himself as a manufacturing machinist at Rock Falls, Ills., and is giving particular attention to the manufacture fo special machinery and machine tools. He is now building some special barbed-wire machines and a set of improved butter-tub machinery. He also reports a large quantity of job and repair work in hand. Machinery is constantly being put in the works as required.

On the 1st of January the Bellefonte Iron and Nail Co., Limited, of Bellefonte, Pa., began the manufacture of steel nails under the Bernard Louth patent for rolling nail plate from steel rails and crop ends. The patent is owned by the company, but the intention is to introduce the process into a limited number of other mills. There is also talk of turning the Bellefonte Car Works into shovel and tack works early this year to use steel made under this patent.—*Industrial World.*

The Knoxville Car Wheel and Machine Company has received an order from the Savannah, Florida and Western Railroad for 1,200 wheels on axles to be delivered by the first of May, when they change to standard gauge. The machine department of these works is so crowded that they will be compelled to run night and day for the next four months. They intend adding several new tools to their plant. They are, at present, making 100 wheels per day.

The Anchor Manufacturing Company, Detroit, Mich., is now fully organized with a paid-up capital of $500,000. The business of this company is of a novel character, viz.: the manufacture of *one stave* barrels. The present capacity of the works is 6,000 barrels, but they intend to double that number in a short time. These barrels, which are attracting considerable attention, are the same size and shape of a common barrel, but consist of a single sheet of elm timber held together by hoops. The barrels can be shipped "knock-down" three thousand in a car and be put up at destination.—*Journal of Progress.*

The Board of Trustees of Hyde Park, Ill., is now considering the advisability of creating a special drainage district of 758 acres, with sewers, pumping-engines, etc., to cost $116,000, the cost of operation and maintenance to be annually assessed upon the district. At the meeting January 11, also, an ordinance was ordered engrossed for the erection of the 15,000,000 gallon pumping works and for the purchase of a site for the pumping station. A resolution was passed directing the Superintendent of Public Works to proceed to erect an addition to the village hall, according to his plans already approved of.—*Sanitary Engineer.*

The following railroads are under contract for building in Florida: Forty miles of road from St. Andrew's Bay to a point on the Louisville & Nashville Railroad, which company is building the line. The Seneca, Fort Mason & St. John's River Railroad, from Fort Mason to Hawkinsville, twenty-five miles. An extension to the Florida Southern Company's lines. Work on the extension of the Florida Railway & Navigation Company's road is progressing rapidly. The South Florida Railroad is being extended. The Jacksonville, Tampa & Key West Railway is building an extension equal to the present mileage of the company's lines.—*Railway Register.*

Complaint is made of a great scarcity of hands in nearly all departments of the silk industry at Paterson, N. J., and learners are being taken on. It is only a few months since nearly every silk mill in Paterson had placards hanging outside the door, "No Hands Wanted," "No Hands Need Apply," and the like, and even skilled operatives could find no employment. Fully three-fourths of all the silk mills are working overtime, and the streets are lined every night about nine o'clock with mill operatives returning from their frames and looms. Ground was broken on Wednesday for the large addition to the Riverside Silk Mill alluded to last week.—*Journal of Fabrics.*

These is some talk of putting in another pump at the water-works at Buffalo, N. Y., this year. The city last year laid pipes for 7,000,000 gallons daily supply, which makes the whole system capable of furnishing 52,000,000 gallons a day. Now we have four pumps, one of 10,000,000 and three of 15,000,000 gallons capacity each, making 55,000,000 gallons in all, only 3,000,000 gallons in excess of the pipes, so it is quite probable that another pump will be added this year. Definite steps have been taken at last to supply the citizens of Buffalo with natural-gas for fuel. The certificate of incorporation of the Buffalo Natural-Gas Fuel Company, limited, has been filed. A petition has also been presented to the Common Council asking for permission to lay and maintain pipes in the streets the city.—*Sanitary Engineer.*

Reports from the cotton mills at the South show that they are doing well, and apparently are on the eve of a boom. The Randleman Mfg. Co, say they were never doing better. They make a superior quality of goods. The Charleston Mfg. Co., Charleston, S. C., under the careful management of its agent, K. B. Adams, has pulled through the hard times with some gain, and a brighter prospect for the future. Reports show goods moving, and at fair prices. Among the prosperous mills of the South, perhaps none is more carefully managed than the Clifton Mfg. Co., Clifton, S. C., D. E. Converse, president and manager. This mill is fully equipped with American machinery of the latest and most improved kind. The result is good goods, made cheaply, command the best prices, quickly sold, and, consequently, dividends to the stockholders. This company is reported to have made enough the past six months to more than pay their semi-annual three per cent. dividend.—*Fiber and Fabric.*

In October, 1884, says the Boston *Commercial Bulletin*, the Cambria (Pa.) Iron Company made a reduction of ten per cent. by a readjustment of the wages of all their employes and officers. The reduction was apportioned to the amount of wages or salary received by each. The proposed general increase of wages, which is to be made without petition on the part of the employes, will probably date from the first of February, or soon thereafter. There will be an average increase of ten per cent. and the advance will be made on the same scale as was the reduction made in 1884. For several months the men have been making full time, except in a few specialties in the steel department. This fact, with the addition of the ten per cent. increase, will make an aggregate of $200,000 per month to be distributed among the employes, whose monthly pay roll is now $150,000. The system of paying wages is very advantageous to the town. The employes of the rolling-mill, steel works, furnaces and mines are paid on the last Saturday in each month. The men in the Gautier Steel Department get their money on the first Saturday after the 15th of each month, thus making two pay days, which are appreciated by the shopkeepers.

Machinists' Supplies and Iron.

NEW YORK, Feb. 4, 1886.

The bad weather of January had some influence in postponing trade, but beyond this supply business and manufacturing are improving. Manufacturers, as a rule, have more orders in hand than at any previous time for months, and are generally hopeful of the future.

Iron—Transactions in American pig are quiet, due to considerable stocking up at the beginning of the year. The outlook, however, is favorable. We quote Standard Lehigh and North River brands $18 to $18.50 at tidewater for No. 1 X Foundry, $17 to $17.50 for No. 2, and $15.50 to $17 for Grey Forge.

Scotch Pig—The demand has shown no improvement We quote Coltness, $20 to $20.50; Glengarnock, $20.50 to $21, to arrive; Gartsherrie, $20 to $20.50; Summerlee, $20; Eglinton, $18.25; Langloan, $20, and Dalmellington, $19.50 to $19.75.

Lead—The market for pig is dull. Consumers are unwilling to replenish stocks at present prices, and holders are not disposed to make concessions. Small sales have been made at 4⅛c. to 4 55c.

Copper—There is no improvement in the demand. Lake is held at 11⅛c.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Experienced tool draftsman seeks a position. Address O. K., AM. MACHINIST.

Job wanted by first-class pattern-maker. Box 379, South Norwalk, Conn.

Wanted—Situation as foundry foreman, by a man of long experience on machinery and steam-engine work; knows how to handle men, and understands mixing metal. Address Mixer, AM. MACHINIST.

Wanted—A man with good mechanical knowledge and experience, familiar with printing machinery and competent to take charge of work and men. Address "Jamieson," AM. MACHINIST.

Wanted—A draftsman to assist in planning and carrying out additions to buildings and machinery, in a manufacturing establishment. Address "R.," P. O. Box 2, Wilmington, Del.

Wanted—Draftsman experienced in printing machinery. Address, stating age, extent and character of experience, education and expectations as to emolument, "Sebastian," AM. MACHINIST.

Wanted—Working foreman for a medium-sized foundry doing general work, and occasionally building a stationary engine; state age, experience, wages, and reference. Address Working Foreman, AM. MACHINIST.

Wanted—Position as foreman or superintendent of mach. shop; large experience in machine and tool building, and management of help; first-class references to those who mean business. Address Box 367, Waterbury, Conn.

Wanted—Time-keeper and cost clerk for a medium-sized foundry, machine and boiler shop; young man preferred, at moderate salary; state age, experience, salary, and references. Address Time Keeper, AM. MACHINIST.

Wanted—Situation as foreman of machine room. Experienced in the management of machinists, die-makers, etc., drafting tools, fixtures, and special machinery, making and running engines, and millwrighting. Address "Systemizer," AM. MACHINIST.

Energetic mechanical engineer and constructor, theoretical and practical, wishes position as superintendent or chief draftsman; 15 years' experience as constructor, engineer, manager and expert in Europe and in this country. French, English and German. Address S. Kunzman, 32 Maiden Lane, N. Y.

Wanted—Machinery and supply salesman, by an established house; one familiar with Southern trade preferred; to the right party, with good references, would sell an interest in the business. Address "Machinery, Engines and Supplies," AM. MACHINIST.

A competent man, who is now superintendent of of an establishment employing over 200 men on light work, wishes to change his position; is a good, practical draftsman and mathematician, and experienced in designing special machinery and tools. Address "Mechanic," Box 245, Hartford, Conn.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

The Crescent Steel Tube Scraper is king. Crescent Mfg. Co., Cleveland, Ohio.

Light mach'y of all kinds built at short notice. Pennington & Mills, 8 Dey st., Jersey City Heights, N. J.

Special mchs. for any kind of mfg. designed to order. Also plain and autom'c eng's. Send for circular and refs. Weston & Smith, Syracuse, N. Y.

To make room for larger tool, will sell cheap, for cash, a planer 42″x42″x12′, in good order. Address P. O. Box 2085, Bridgeport, Conn.

C. F. Langston & Co., 222 N. 5th st., Phila., canmakers' tools, presses, dies and special machinery built, rotary cutters made and ground.

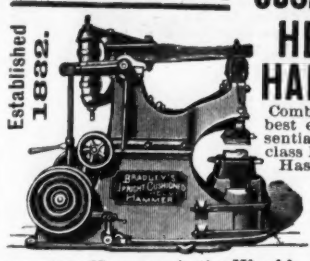
Gear Cutter—For sale, cheap, by Fitchburg Machine Works, manufacturers of machinists' tools, Fitchburg, Mass., one second-hand 36″ (Putnam) gear cutter, in good condition.

For Sale—Shafting lathe, 28″ swing, takes 20′ between centers; treble-geared; 5 speeds on cone, for 2½″ belt; screw feed, but not screw cutting; also cylinder boring-bar 6″ diameter, screw feed; cutter-head 9″ diameter, 60′ traverse. A. L. Henderer, Wilmington, Del.

Engine and Boiler—30 horse-power Buckeye engine; 42″x12′ tubular boiler; all pipes and fixtures, including injector, heater and smoke-stack; the whole in good condition; in use about three years; to be replaced by larger engine, etc., of same make; can be seen in operation until Mch. 1. Address Geo. A. Barnard, 70 Astor House, New York.

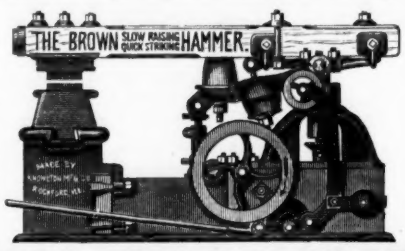
BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1832.



Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

BRADLEY & CO. Syracuse, N.Y.



THE BROWN HAMMER

STRIKES A BLOW WITH

DOUBLE THE VELOCITY That it Raises the Hammer.

A NEW MOVEMENT! SEND FOR DESCRIPTION.

KNOWLTON MFG. CO., King St., Rockford, Ill

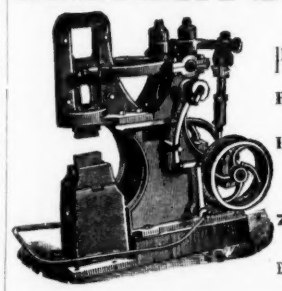
FOR SALE AT A BARGAIN.

A well established and good paying machine shop and foundry, including buildings, lots, machinery and stock, situated in Leadville, Col. The business will be carried on until sold, thus at once giving a profitable trade to the purchaser. Address,

A. FALKENAU,
Care of Dickson Mfg. Co.,
Scranton, Pa.

Only reason for selling, ill health.

BEAUDRY'S UPRIGHT CUSHIONED POWER HAMMER.



By far the Best.
Blow Accurate, Powerful & Elastic.
Will Increase the Profits of any Shop.
70 Kilby Street, BOSTON, MASS.
BEAUDRY & CUNNINGHAM

THE DUPLEX INJECTOR
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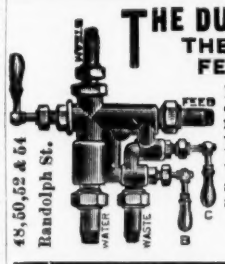

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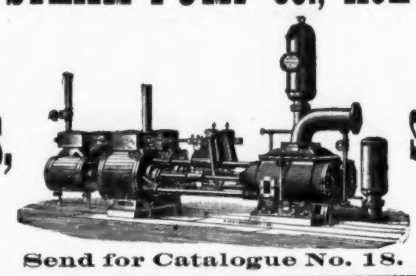

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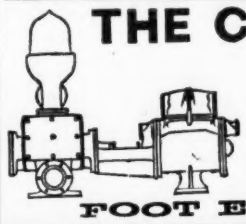

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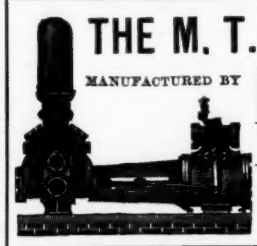

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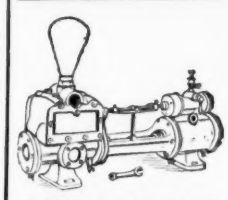

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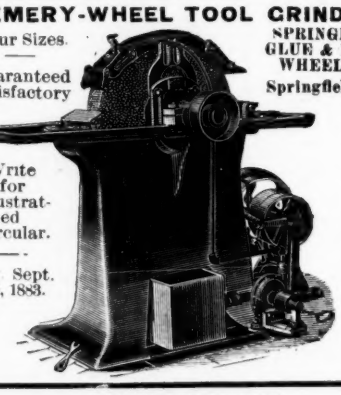

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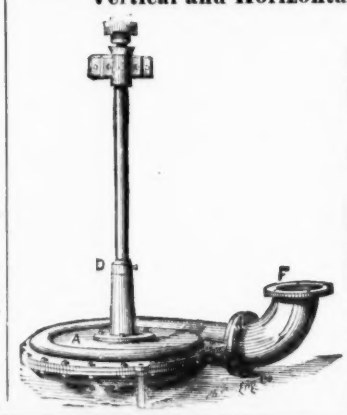

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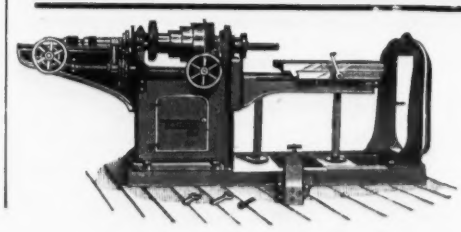

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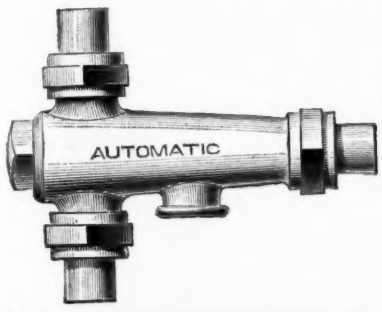

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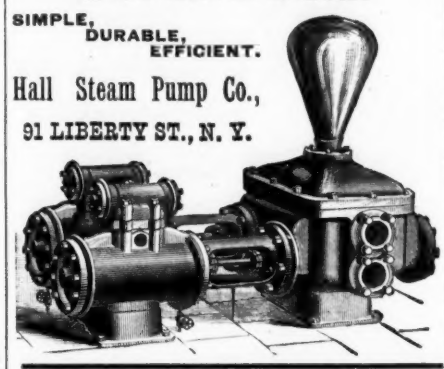

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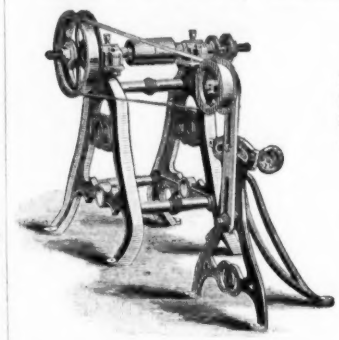

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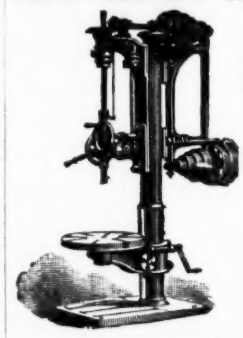

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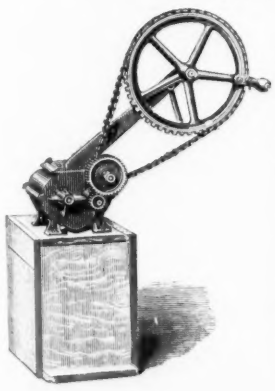

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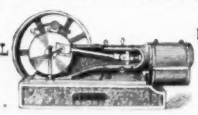

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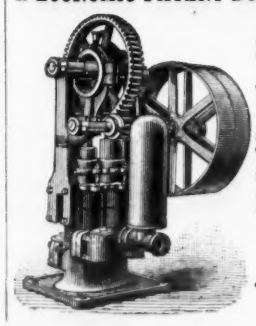

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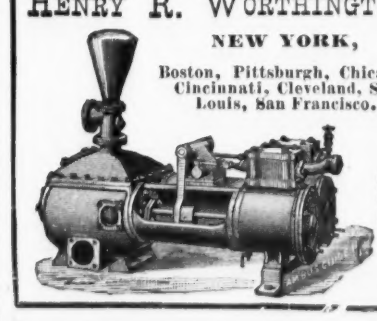

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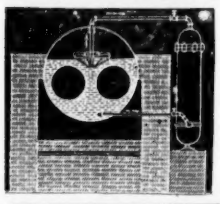

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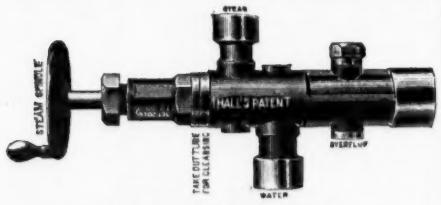

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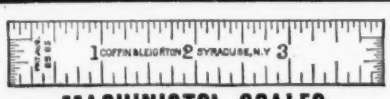

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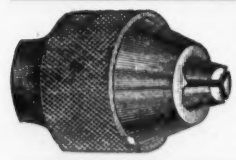

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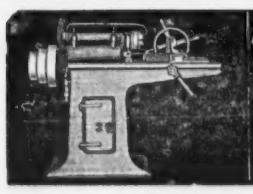

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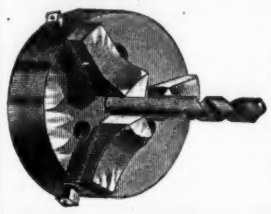

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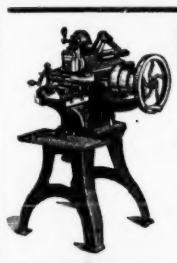

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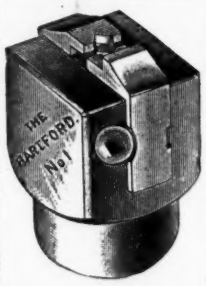

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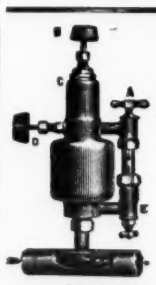

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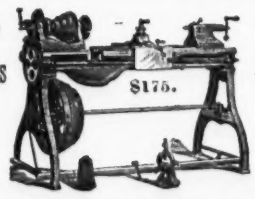

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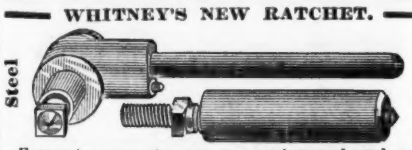

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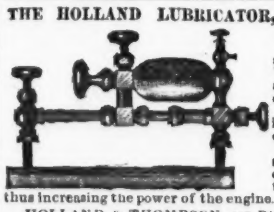

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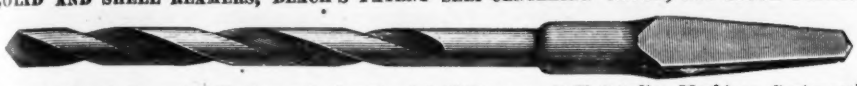

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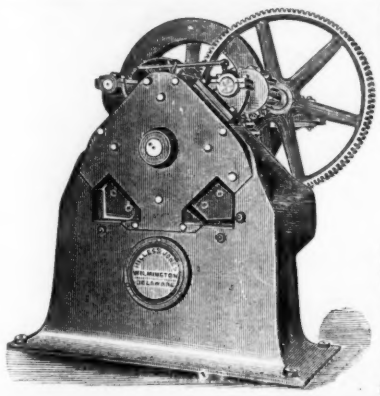

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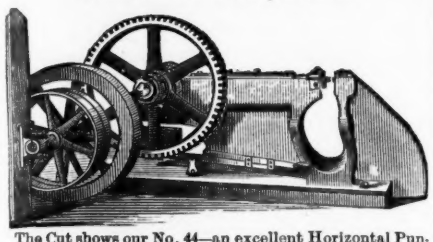

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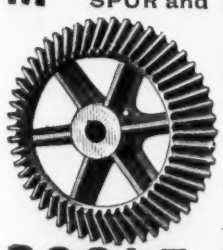

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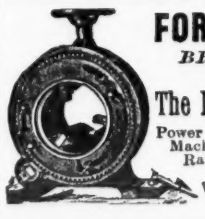

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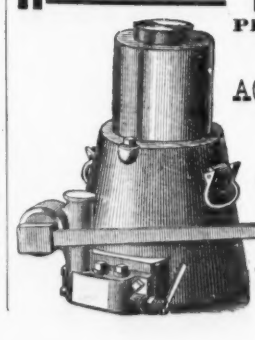

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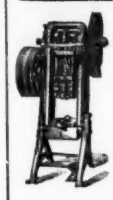

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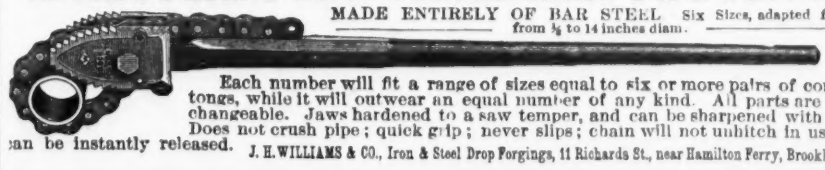

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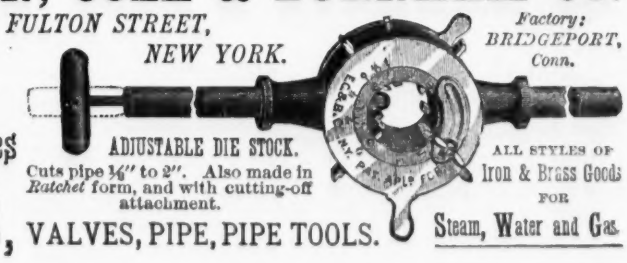

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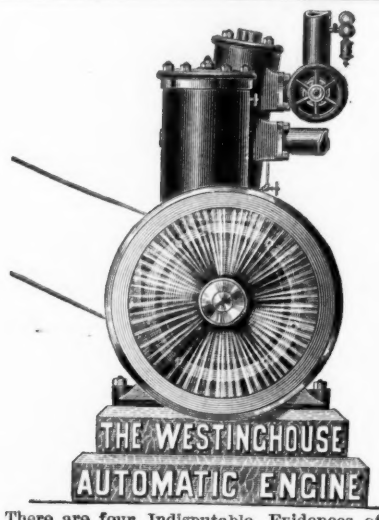

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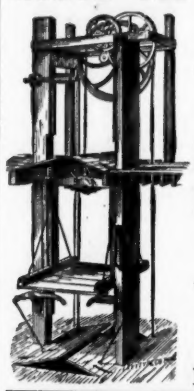

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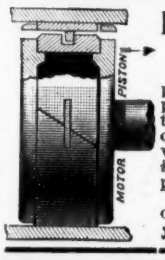

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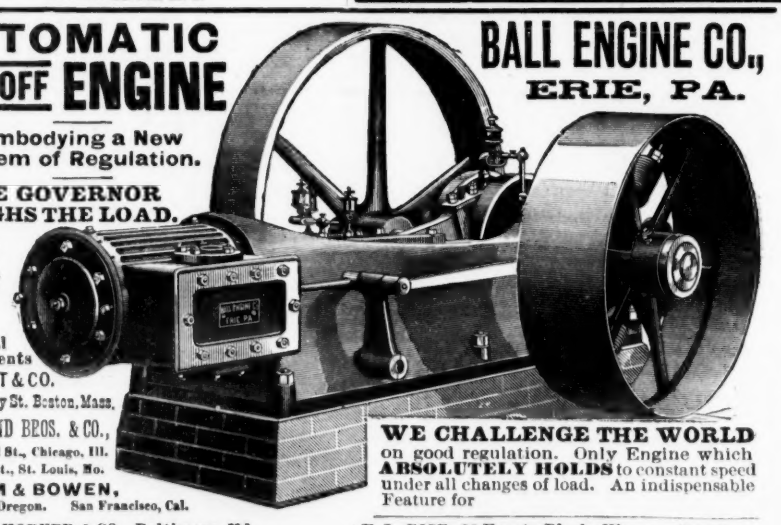

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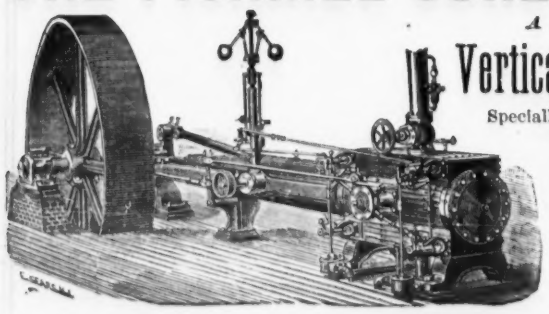

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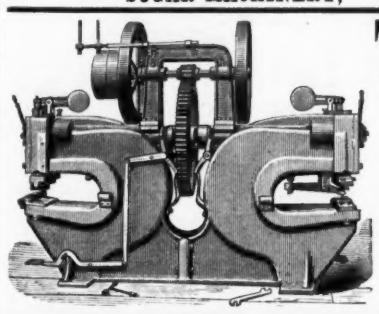

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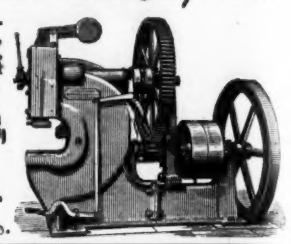

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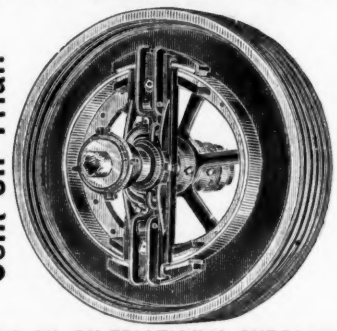

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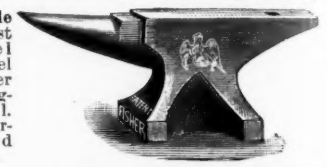

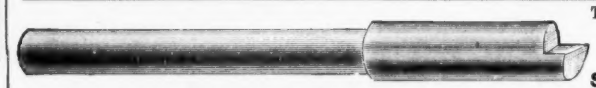

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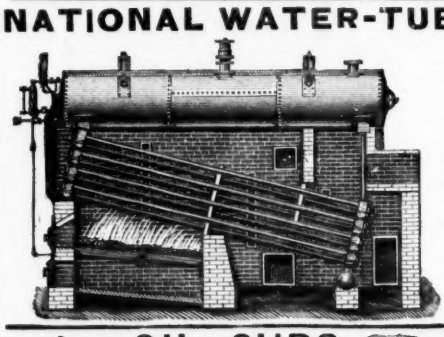

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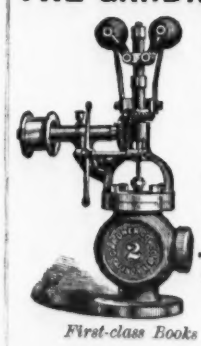

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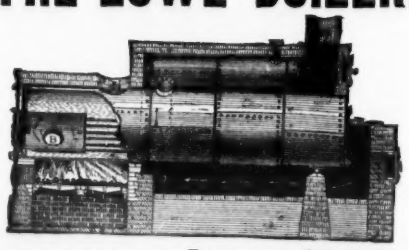

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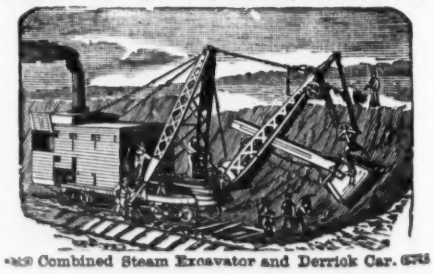

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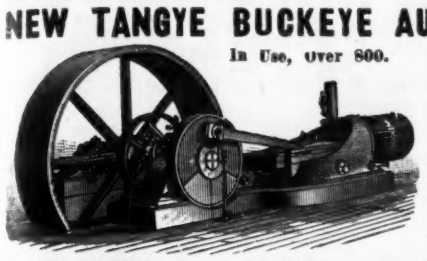

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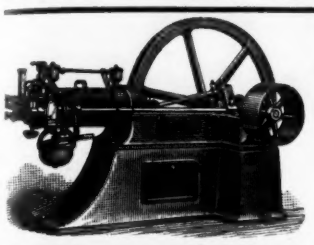

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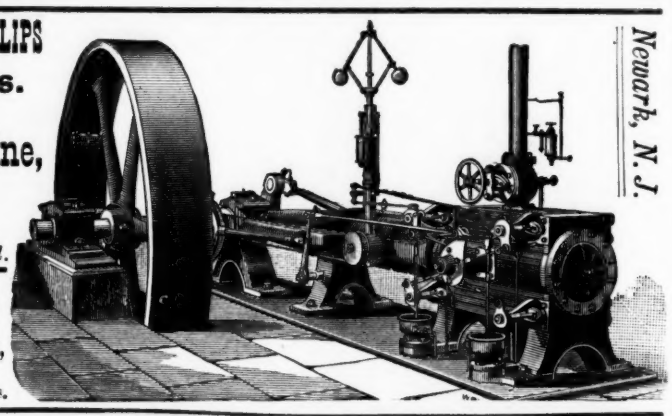

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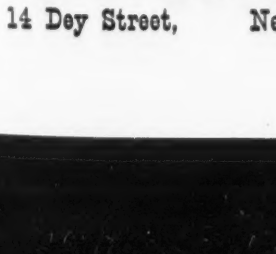

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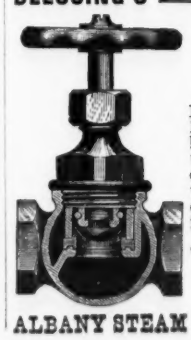

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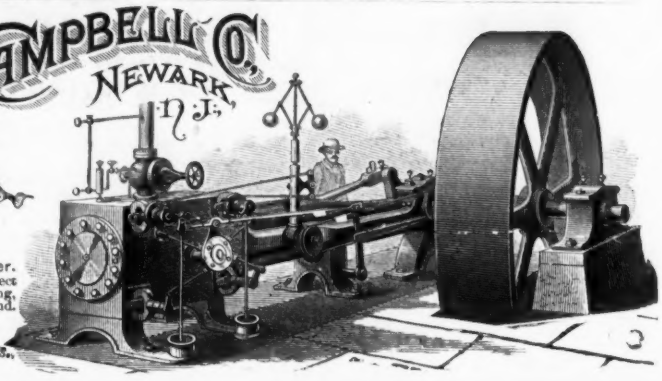

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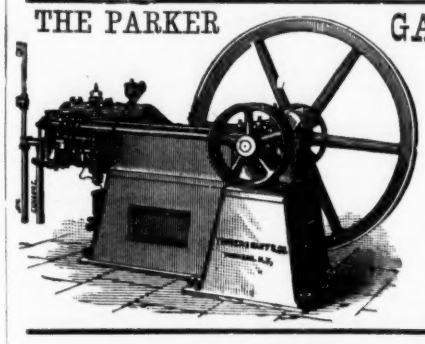

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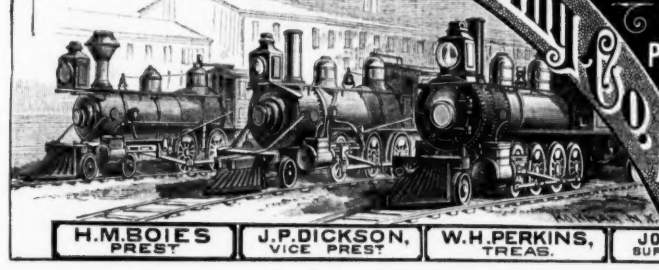

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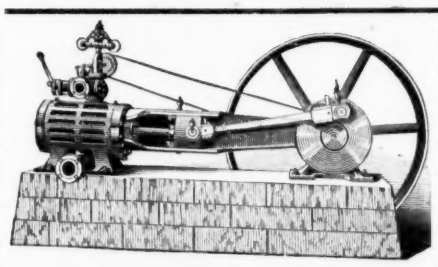

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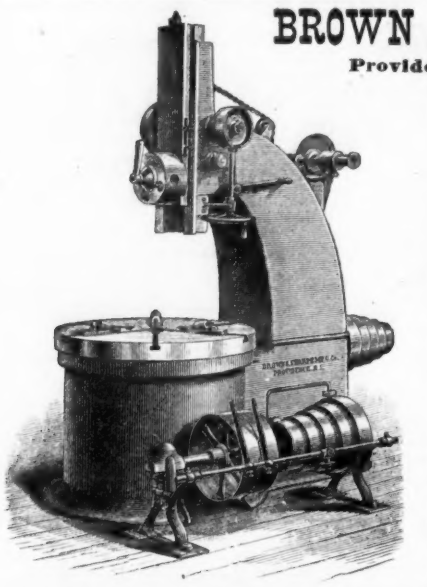

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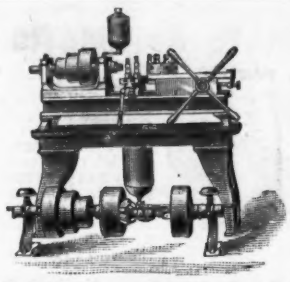

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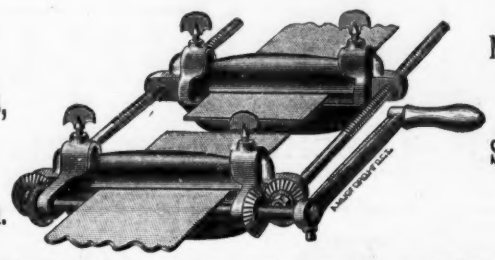

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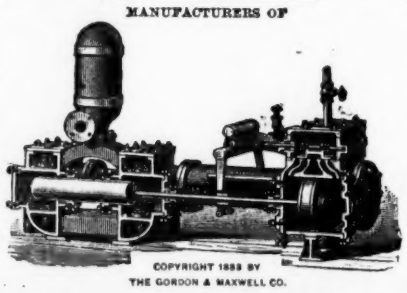

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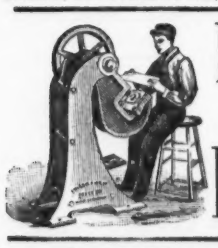

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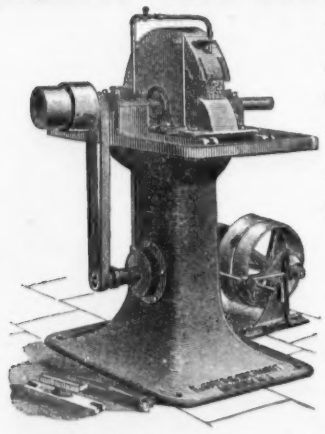

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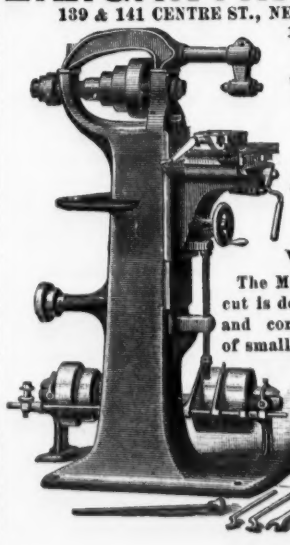

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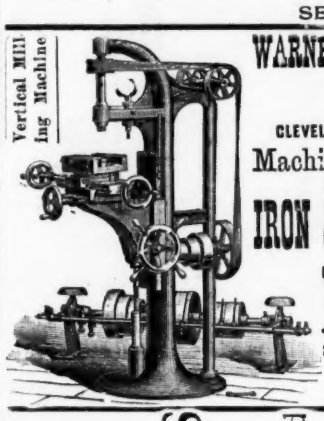

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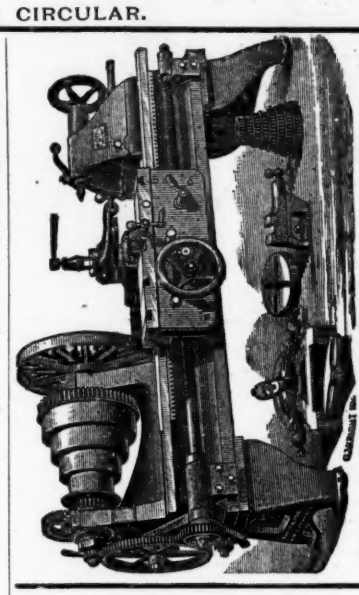

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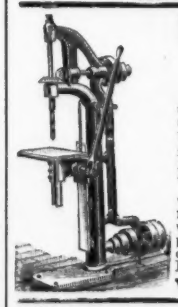

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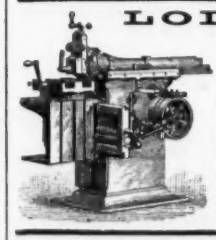

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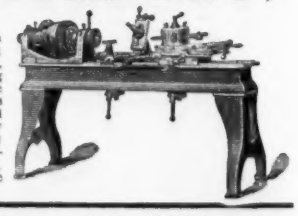

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